APPLIED HYDRAULICS

MARCH

THE MAGAZINE OF FLUID POWER including Air Controls, Air Circuit Design and Electrical Controls...

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Designer's Sketchpad of Mechanisms . . . page 69

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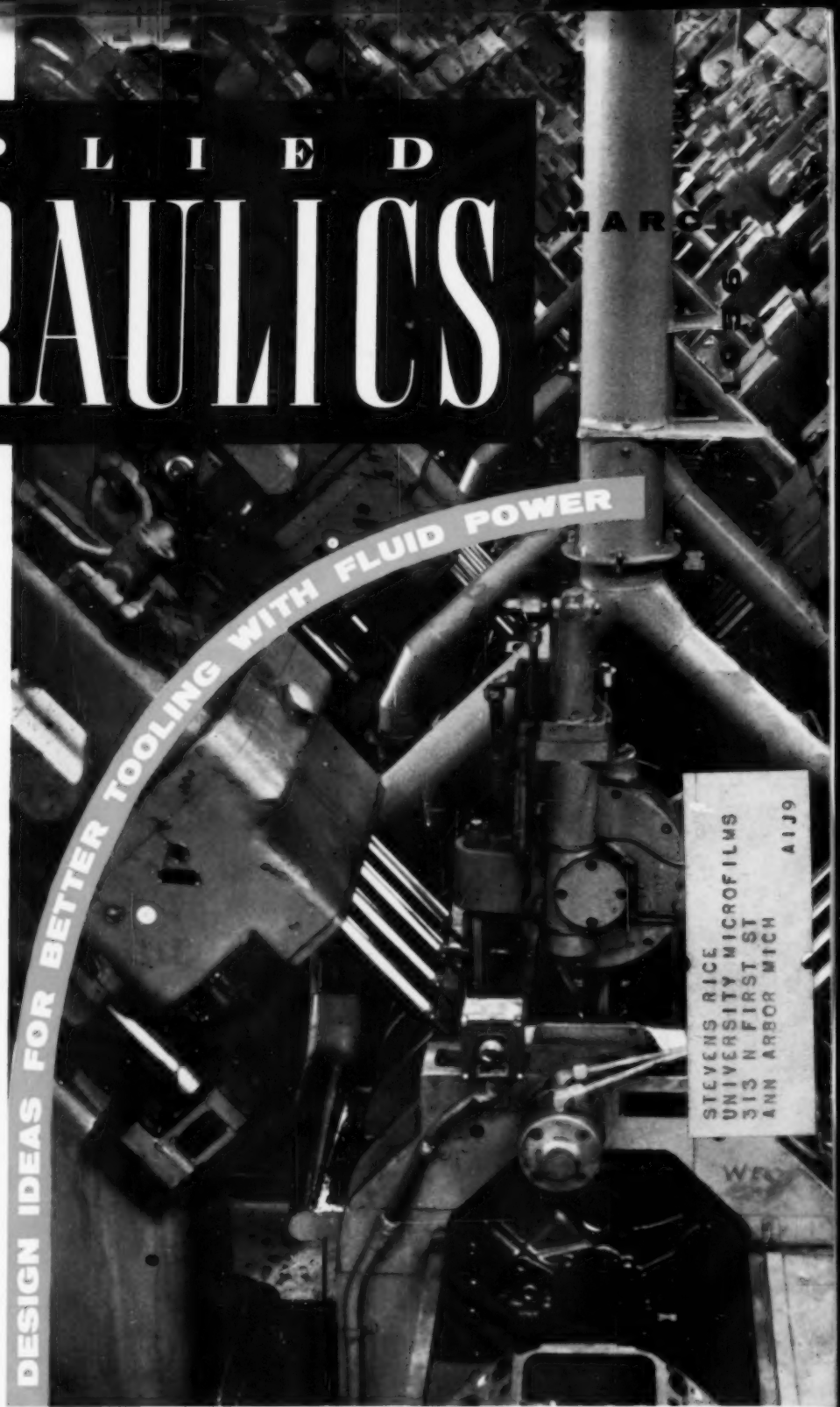

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CIRCULATION FRANCHISED

Your Guide to Exhibitors of Fluid Power Products at the 1956 ASTE Industrial Exposition, March 19-23

See page 100

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2-WAY SHUT-OFF

COUPLINGS!

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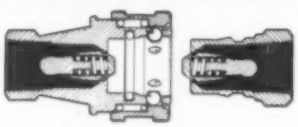
INSTANT AUTOMATIC FLOW OR SHUT-OFF



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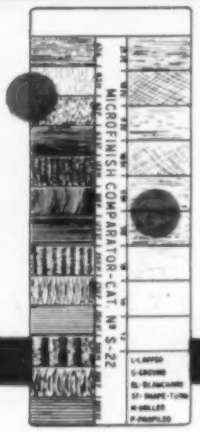
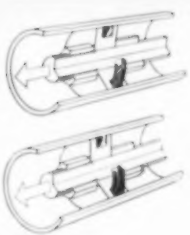


save money with a seal that needs only 60-100 micro-inch groove finish to replace O-rings that need 10-20.

new answer:

minnesota rubber's money-saving new



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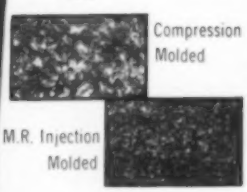
QUAD RINGS eliminate "spiral twist", a common cause of packing failure. At any pressure, less squeeze is required with QUAD RINGS than with O-rings. Truly effective sealing even for pressures as low as 0-5 psi. QUAD RINGS also give a positive seal under high vacuum. The 4-lip sealing surfaces reduce breakout and running friction—giving longer life. Seal perfectly even with a rougher groove finish.



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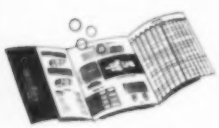

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Free samples of QUAD RINGS are available together with a descriptive brochure with technical information and installation data. QUAD RINGS are the result of intensive research and field testing. Made to closest possible dimensional tolerances. We urge you to inquire about this revolutionary new seal today.

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THE MAGAZINE OF FLUID POWER

MARCH 1956
VOLUME 9 NUMBER 3

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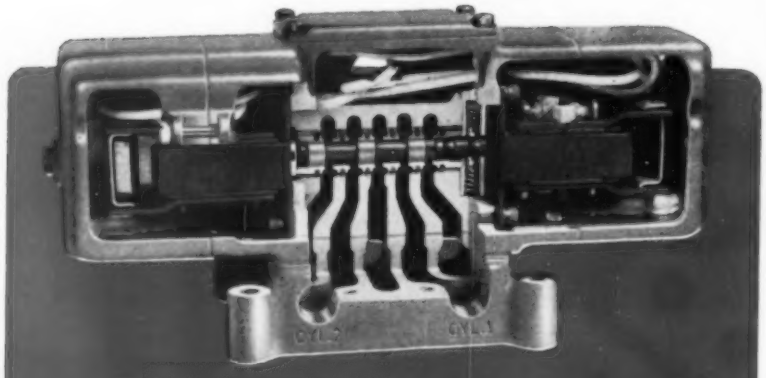

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HOW MODERN ARE YOUR HYDRAULIC HOSE ASSEMBLIES? LET ME TELL YOU ABOUT A FEW ANCHOR EXCLUSIVES?

For instance:

—the Anchor "Flanco" Split-Flange Couplings, employing the "O" ring seal, actually put hydraulic Hose Assemblies years ahead with a new versatility and longer dependable service life. They eliminate gaskets, tapered threads, sealing compound, separate union and swivel connections and the greater the pressure — the tighter the seal.

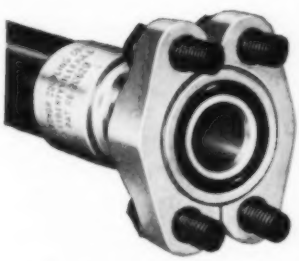
Catalog No. 400 gives you all the facts!

And

—there's the New Anchor commercial "Duloc" Coupling for style QW and QWR Hose, a streamlined design featuring ease of installation in confined places and convenient emergency repairs any place. They can be reused without need for replacement parts. Ideal for plumbing of experimental machines. They will materially reduce production downtime when repairs are necessary.

Catalog No. 300 gives you full information on complete "Duloc" Assemblies.

Andy Anchor



Anchor "Flanco" 4-bolt, Split-Flange Couplings.

Anchor Commercial "Duloc" Reusable Couplings for Style QW and QWR Hose.

Also ask for

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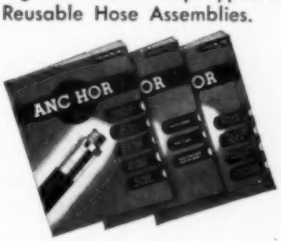
Catalog No. 200—Anchor Adapters, Adapter Unions and Pipe Fittings.
Catalog No. 300—Clamp Types and Reusable Hose Assemblies.



Write for these catalogs

ANCHOR COUPLING CO. INC.
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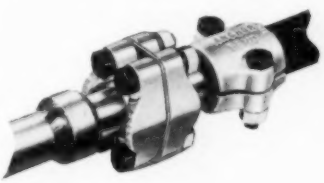
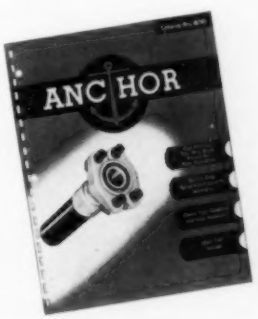
Useful Literature

NEW O-RING SPLIT-FLANGE DATA

The Anchor "Flanco" Split-Flange Coupling, offering exclusive patented features, has developed a wide spread interest in all fields of pressure and suction applications. It provides a tilt and blow-out proof clamp. By locating the plane of the split-flange clamp half bolt centerlines, so that it passes through the center of force of the flanged head on the split-flange clamp half, unbalanced moments are eliminated. This patented design principal prevents tilting of the clamp half and extrusion of the "O" ring. The beam type construction of the clamp halfs makes them structurally strong and capable of withstanding, without distortion, pressure exceeding the bursting pressure of high pressure hose.



The "Flanco" Split-Flange Coupling permits disconnect and reconnect of hose lines time after time without leaks—there are no threads to wear out, no tapered seats to groove. Thinner sections can be used on valve and pump bosses, saving size, weight and money. Production costs are reduced by the elimination of costly pipe threading operations. Separate union and swivel connections are eliminated. Deflection or twisting of the hose is eliminated in make-up of joint, permitting use of short stiff assemblies. Only small automotive type wrenches are required for make-up of joints.



A wealth of information has just been published on the "Flanco" Split-Flange Coupling line, including illustrations, diagrams and technical data on all three types (pressed-on, clamp and weld-type) available. This data is given in the new Anchor Catalog No. 400, a copy of which may be obtained by writing to the Anchor Coupling Co. Inc., 346 North Fourth Street, Libertyville, Illinois.

Fluid Power Lines

about Applied Hydraulics

PROFIT OR LOSS? . . . . Having spent several years in a small machine shop, we know first hand that the difference between a profit and a loss often depends on the jigs and fixtures which are used. That's what makes tool design fun.

To add to the excitement of designing tooling is the pressure of time. The parts were wanted yesterday, which means the jigs should have been done a week ago. So away we go. Time only permits a few approaches at the drawing board and only one when the toolmaker starts cutting steel. At this point, ideas for clamping, indexing, positioning, etc. are quickly sketched and what we think will be best is selected. To help us with this selection, we kept a notebook of sketches which were borrowed or adapted from past designs.

There are a number of tooling ideas using air or oil power in this issue. We hope you'll find the "Designer's Sketchpad," starting on page 69, a helpful addition to your design idea file.

IF YOU ATTEND THE ASTE EXPO . . . in Chicago, March 19-23, be sure to visit us. We'll be in booth 641 and be glad to talk hydraulics and pneumatics with you. APPLIED HYDRAULICS will be one of 50 exhibitors who will feature service and products for fluid power applications. To get the entire picture of the Exposition take a look at page 103. Your guide to Fluid Power Products starts there.

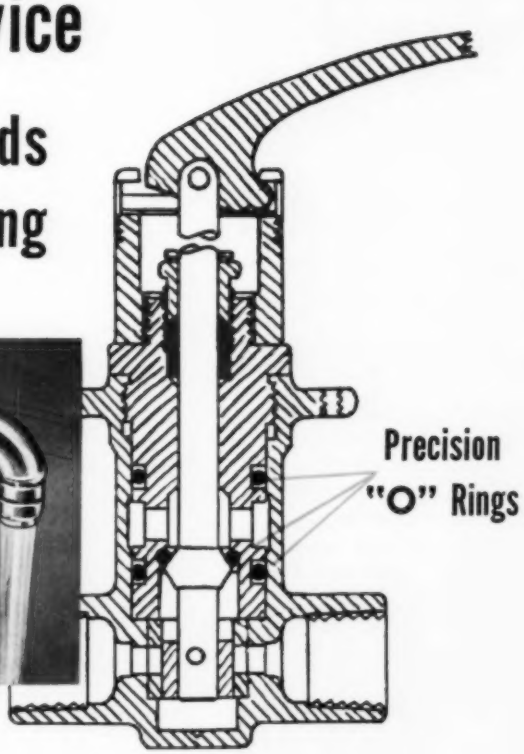
NO BROKEN DRILLS . . . It's obvious that drilling time depends on rate of feed. How fast can you push a drill through the work without getting a severe lunge when the drill breaks through? Here's a critical problem when small diameter drills are used in a multi-spindle drill head. Jim Tankard, a Zagar Tool machine designer, describes, in an article on page 65, how drill lunge was eliminated on a high production machine.

PRESS TOOLING . . . On page 78 El Friedl tells about an accumulator and intensifier circuit powering cylinders which replaced pressure pad and stripper springs on a form and pierce press. Here's a tooling idea which saves space, and dollars by minimizing press downtime caused by spring failure.

WALKING AROUND ON METAL CHIPS . . . can be pretty hard on the shoes. "A pair of shoes used to last an operator about two weeks," said Bob Blandford at Jones & Laughlin in Pittsburgh. "With the new loading equipment on our dual milling machine, they're good for 6 months." Here's an interesting advantage of hydraulic transfer equipment that we've never considered before. Not only is machine production much greater, but operators can cut their shoe bills. Much easier on the corns too!

New Faucet with Precision "O" Rings gives longer service

...ends dripping

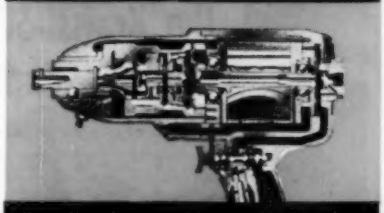


The Gyro Brass Manufacturing Corporation water faucet has no washers, spindles or seats to replace or renew. With the aid of Precision "O" Rings, a single motion controls both water volume and temperature. Dripping is eliminated. Endurance tests indicate ring life of over 15 years of normal service.

For Gyro Brass Manufacturing Corporation, and for hundreds of other manufacturers, the use of Precision "O" Rings means dependable long life service. They are compression molded—rigidly inspected—meet all military and commercial specifications—the finest made! At Precision, you'll find "O" rings in sizes and compounds to meet your requirements.

What is your sealing problem? There is an expert—the Precision engineer—ready to help you in product design and "O" ring specifications. You can rely on him—and on Precision, the world's largest exclusive producer of "O" Rings.

Job fitted Precision "O" Rings have solved hundreds of industrial, aircraft and automotive sealing problems.



In air-powered impact wrench, 14 floating "O" rings help achieve compactness, result in reduced break-out friction and lower running friction.

Write for your free copies of Precision catalogs on "O" Rings and Dyna-seals

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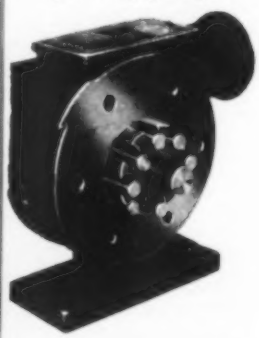
Primary Oil Pumps • Vacuum Powered Transmission and Low Pressure Air Service • Air and Liquid Filters •

What's your problem?

- higher pumping speeds?
- tolerance of particle-laden liquids?
- peak suction for primary pumps?



the Kraissl-50 Roller Pump

is unmatched for dependable performance on every one of those counts.

Bulletin A-1330 has full data . . . write for it. The roller-rotor design easily handles particles that would jam more tightly-fitted mechanisms—reduces cavitation, allowing higher speed operation*—develops high suction characteristics.

*Roller mechanisms permit higher speeds with any oil than most displacement designs.

KRAISSL CO

305 Williams Ave., Hackensack, N.J.

Fluid Power Lines

continued

WE DON'T OFTEN VISIT . . . a plant as swank as Kearney and Trecker's new division for special machines. As a matter of fact, we've gotten pretty adept at dodging oil splatter. That's why K & T's engineering offices overlooking their spacious manufacturing floor, their huge lobby dramatically displaying a spotless white milling machine, and the latest and most modern in office equipment all impressed us when we got material for the hydraulic index discussed on page 75. Air conditioned throughout, the offices are bathed in the restful glow of indirect fluorescent light. Incidentally, we hear they're always interested in bright engineers.

CYLINDER PACKINGS . . . The beginner in the fluid power field will get some interesting pointers about nonmetallic packings from E. P. Stahl's article. Because packings often turn out to be the weak link in a hydraulic system, know-how about materials, shapes, installation and troubles can pay off handsomely.

SAFETY . . . Good tooling does the job safely. In the articles in this issue design for safety is referred to many times. One pneumatic circuit whose only purpose is to control a safety mechanism is described by Clifford Lane. Here's a circuit which is being used successfully. If your shop has a punch press which needs a safety guard, here's a tooling idea which you'll want to study.

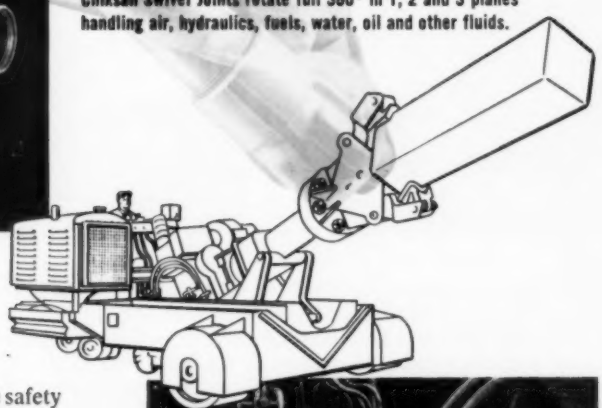
SO WHERE'S THE MONEY? . . . We've got seven checks, guaranteed convertible to 1200 bucks, which are going to be awarded this year to winners of the 1956 APPLIED HYDRAULICS Prize Paper Contest. Judges for the contest are announced on page 22 of this issue. The contest closes July 1st. Awards will be made in October at the National Conference on Industrial Hydraulics. To get an entry blank and some helpful hints use the reader service card—circle number 340.

UNIVERSAL SYMBOLS . . . Across our desk, recently, came the first issue of a French quarterly "Revue des transmissions hydromechaniques". It's the official publication for pump builders. This first issue devotes most of its space to explaining J.I.C. hydraulic symbols for drawings. This may mean acceptance of these symbols in France. Perhaps the British will follow suit despite the wide acceptance of symbols developed during the war by British aircraft designers. Acceptance of J.I.C. would prove helpful to everyone.

CHIKSAN

Works wonders with hydraulic lines

Chiksan Swivel Joints rotate full 360° in 1, 2 and 3 planes handling air, hydraulics, fuels, water, oil and other fluids.



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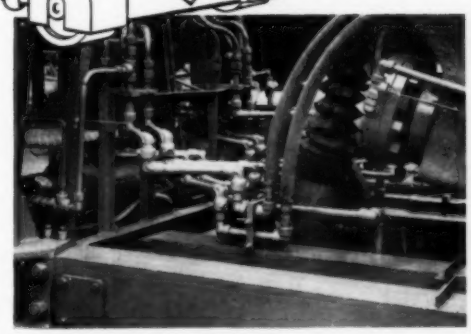
Give metal lines the flexibility of rubber with the safety and service life of steel. And with free swiveling 360° rotation, Chiksan Swivel Joints eliminate line failure due to bend radii and torsion fatigue.

Investigate Chiksan Swivel Joints for application in your plant and on your products. Their modest cost is quickly repaid in savings of down-time, replacements and maintenance.



Installed on hydraulic lines of a Salem-Brosius forging manipulator, these Chiksan Swivel Joints have been in continual service for over 3 years with no down-time to date.

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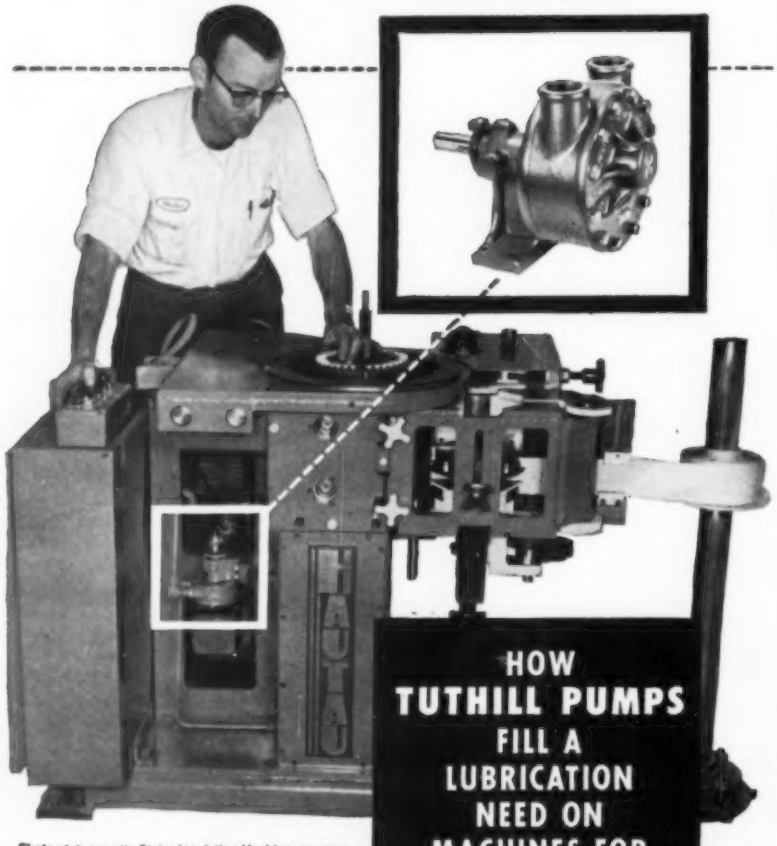


Photo of Automatic Stator Insulation Machine, courtesy Hautau Engineering Company, Ferndale, Michigan

HOW TUTHILL PUMPS FILL A LUBRICATION NEED ON MACHINES FOR AUTOMATION

In developing this machine that automatically forms and inserts insulation for the stators of electric motors, Hautau engineers required a dependable pump for lubricating the various operating gears and indexing mechanism. For this vital service they selected the Tuthill Model C internal-gear rotary pump.

The performance characteristics of this positive displacement pump make it ideal for pressure lubrication. It holds its prime. Instantly delivers the capacity needed. Operates quietly. And it is built for long, uninterrupted service. Tuthill specializes in building pumps for the purpose. Whether your production calls for standard pumping units or special pumps for engineered applications in lubrication, coolant, hydraulic or liquid transfer service, it will pay you to submit your specifications for recommendations.

Write today for complete data on Tuthill Pumps for lubrication or other specific service.

TUTHILL PUMP COMPANY
Dependable Rotary Pumps . . . since 1927
939 East 95th Street, Chicago 19, Illinois

Canadian Affiliate: Ingersoll Machine & Tool Co., Ltd.
Ingersoll, Ontario, Canada

LETTERS to the editor

1956 NCIH

Our company is planning to send its representatives to the National Conference on Industrial Hydraulics. Could you please tell us exactly when, where the meeting is to be held, what is the headquarters hotel, whom to contact, etc?

HAL SHOEMAKER
Mechanical Goods Division
United States Rubber Company
New York, N.Y.

The 1956 NCIH is scheduled for October 18 and 19 at the Sherman Hotel, Chicago. Registration forms can be obtained from the Conference Secretary, Raymond D. Meade, National Conference on Industrial Hydraulics, Illinois Institute of Technology, Technology Center, 3320 S. Federal, Chicago 18, Illinois. The October 1956 issue of APPLIED HYDRAULICS *will include a complete program and abstracts of all the papers to be presented.*

Troubleshooting Info

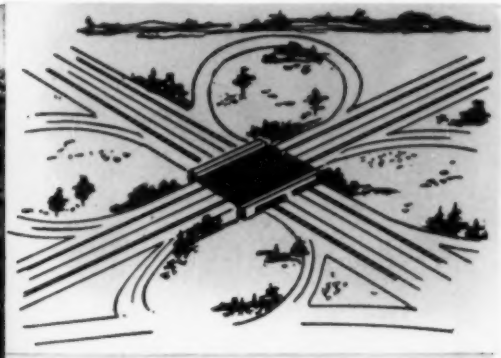
Can you tell me who to contact for books or information on Hydraulic print and symbol reading, also oil weights, viscosity and their meaning?

I have been employed in Kenosha at American Motors for the past nine years as Hydraulic Machine Repairman and find that three of our main stumbling blocks in troubleshooting is our ability to decipher the prints and symbols, and oil weight plates furnished by the machine manufacturer. So many differ in so many respects that we spend too much time pondering instead of repairing.

HARRY SLATER
American Motors Inc.
Kenosha, Wis.

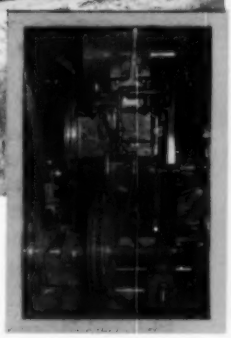
We hope that most of your machine suppliers make their hydrau-

Continued on page 12



GALION 104 Motor Grader, above, uses Eastman Assemblies on *EIGHT* Hydraulic controls for more accurate, effortless and economical grading. Close-up, left, shows powerful Hydraulic Circle Turn for famous Galion "Reversible" Moldboard.

BARBER-GREENE Bituminous Finisher, right, automatically lays level finish for smoother, safer travel. Close-up shows Eastman Hydraulic Hose Assembly delivering 2,700 lbs. pressure to raise and lower finishing screed.



Smoother, Safer Roads

BUILT WITH HYDRAULIC POWER

DELIVERED THROUGH

Eastman

HYDRAULIC HOSE ASSEMBLIES

ALWAYS SPECIFY

EASTMAN Pressed-on, Reusable and Renewable Couplings for high and low pressure air, gas, water, paint, grease and hydraulic fluids. Eastman Straight and Angled Adapter Unions.

Smoother, safer highways are being built today through the application of modern engineering and the use of modern equipment—much of which is hydraulically operated—using Eastman Hydraulic Hose Assemblies.

GALION—pioneer builder of road machinery—whose Motor Graders and Rollers are used 'round the world—first used hydraulic controls as early as 1927. Eastman Mfg. Co. pioneered in the development of Hydraulic Hose Assemblies in 1926—and *Galion is Eastman equipped today!*

BARBER-GREENE—whose Bituminous Road Finishers have been used at one time or another on almost every road ever built—also uses Eastman Hydraulic Hose Assemblies. Hydraulic power is used to raise and lower the all-important mechanism which lays a level finish—regardless of irregularities in the base. Barber-Greene's founding date of 1916 closely parallels Eastman's of 1914—and *Barber-Greene is Eastman equipped today!*

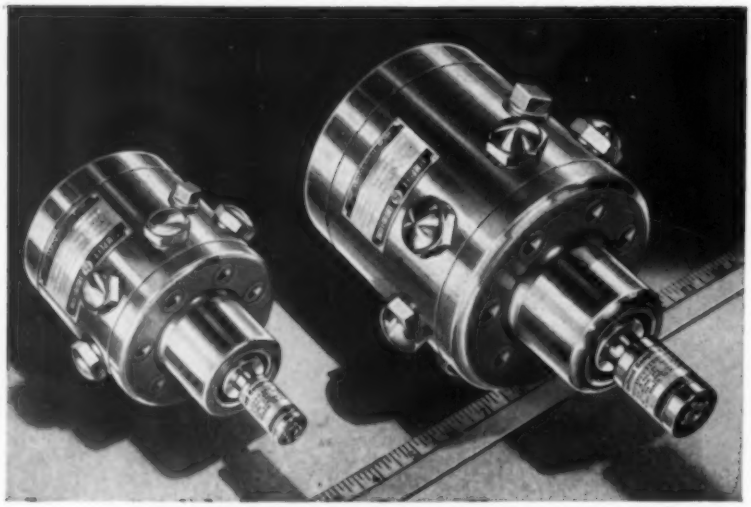
EASTMAN—*first in the field*—is proud to have pioneers such as Galion and Barber-Greene—as well as many other leading American manufacturers—use Eastman Hydraulic Hose Assemblies. Look to Eastman for *continued leadership* in engineering and design for quality of material and workmanship—plus better-than-ever service through expanded production facilities of our new, modern plant.

SAFEGUARDING INDUSTRY'S *Lifelines of Mobile Power*

Eastman
first in the field
MANUFACTURING COMPANY
Dept. AH3, Manitowoc, Wis.

WRITE **for Eastman Catalog or send blueprints stating your hydraulic requirements and specifications.**

Circle 44 on Reader Service Card



designed for 10,000 PSI

—same high efficiency at LOW pressures

SECO radial hydraulic pumps generate pressure *within hollow pistons*. Due to the inherent sealing quality of this design, these pumps develop pressures up to 10,000 PSI without loss of mechanical efficiency.

The LA Series SECO pumps (illustrated) have proved ideal for generating that final "big squeeze" in many high-low operations.

And for applications where no large fluid volume is required, but where higher working pressure would *reduce the bulk of all components*, these pumps open new horizons in the design of oil hydraulic systems.

If, however, your current interest is in pressures only up to the commonly accepted 5,000 PSI range, consider this: At such pressures SECO pumps merely loaf, so far as *stress* and *wear* are concerned. Even at their highest rated capacities SECO pumps rarely require any servicing.

SECO Series LA pumps are made in 5 models, delivering from ½ GPM to 5 GPM, and developing pressures of 500 to 10,000 PSI. Other models are available in greater capacities and higher horsepower.

Whether your interest is in higher pressures, or simply in longer pump life and freedom from servicing—you should be familiar with these pumps. For complete information use the Reader's Service Card.

SECO

SERIES LA "HOLLOW PISTON" PUMPS

SIMPLEX ENGINEERING CO.
ZANESVILLE, OHIO

LETTERS to the editor

lic circuit drawings in accordance with JIC Standards. A copy of our Data List will supply you with sources of literature which will acquaint you with the standards. Literature on hydraulic fluids is also listed.

Reinforced Teflon

In the December article "High Temperature Fluid, Packing and Operating Problems", ceramic loaded teflon is mentioned on page 76. As manufacturers of this material we would like to point out that the product, our Duroid 5600, is more accurately described as ceramic fiber Reinforced Teflon. This difference is important, since Duroid 5600 is the only Fiber Reinforced Teflon in production, as against those Teflon products which are loaded with powdered materials such as glass, bronze, copper and graphite.

The excellent results obtained with our back up rings is because cold flow is prevented by an interlocking network of fibers, rather than by a simple loading of the Teflon.

N. L. GREENMAN
Rogers Corporation,
Rogers Conn.

Hydraulic Institutes

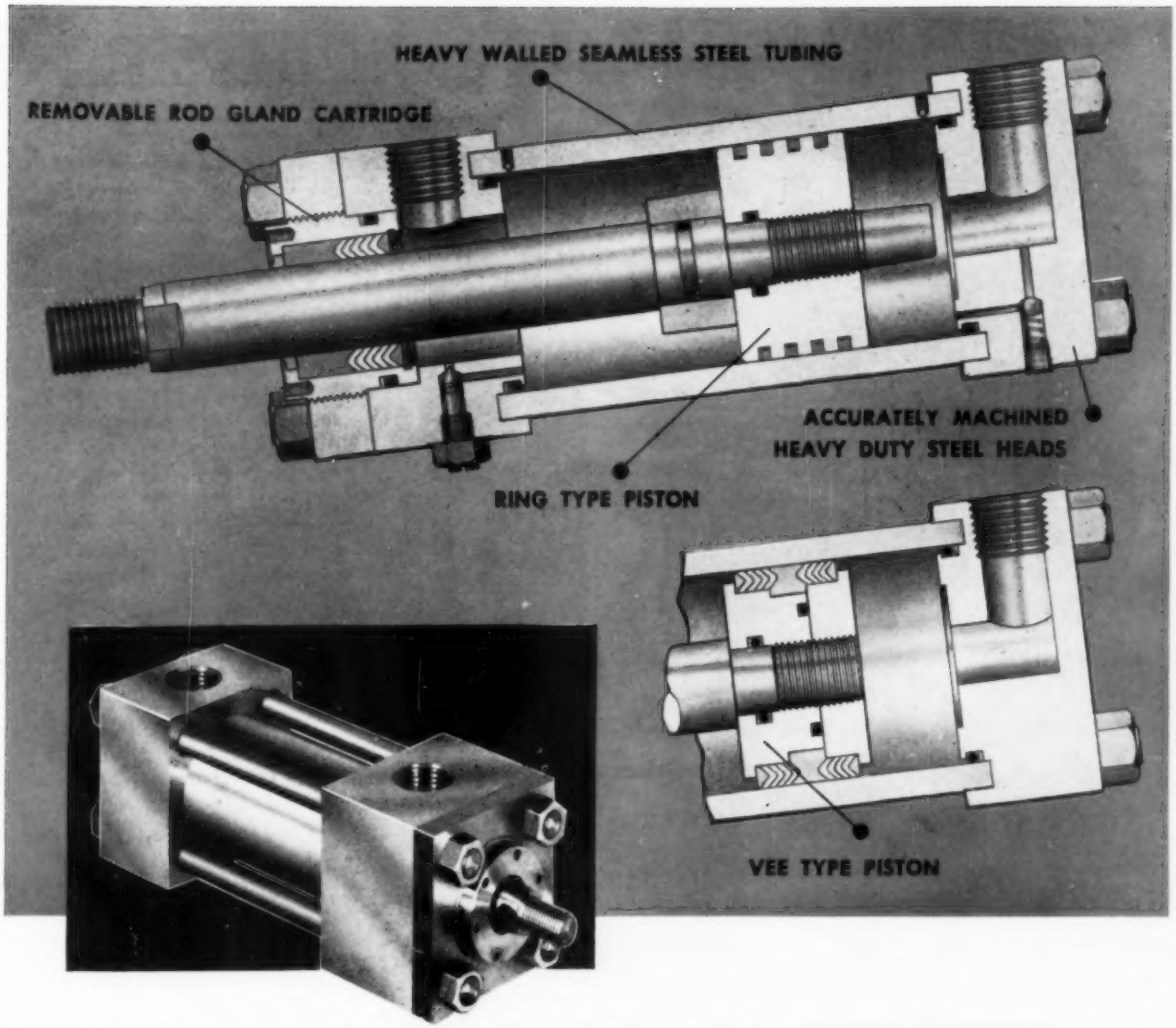
We would like the names and addresses of some of the hydraulic institutes one can join.

K. KEESS
Williams & Wilson Ltd
Montreal, Canada

There are several organizations which you may wish to investigate. One is the Hydraulic Institute. You can obtain information about this Institute from its secretary at 122 East 42nd St., New York 17, N. Y. Members of this Institute are primarily manufacturers of centrifugal and reciprocating plunger pumps such as: Aldrich Pump, Allis-Chalmers, Fairbanks, Morse, Goulds, and Worthington.

A second organization, in which companies participate as sponsors,

Continued on page 14



New Hydraulic Cylinder Designed for High Pressure Heavy Load Applications

A new hydraulic cylinder conservatively rated at 2000 PSI has been developed by the Ortman-Miller Machine Company. This cylinder meets JIC standards and is designed to provide maximum performance with minimum maintenance to meet the demands of modern industry.

To insure a combination of performance and dependability Ortman-Miller specifications include: heavy walled seamless steel tubing micro-honed for minimum friction; rolled steel heads recessed to confine the tube, prevent breathing and provide additional protection against leakage under the most severe usage;piston rods hard chrome plated, turned ground and polished from stress relieved high tensile steel; multiple lip self-compensating rod gland packing providing excellent pressure sensitivity with long life. This packing is contained in a removable cartridge which facilitates replacement without disassembling the cylinder.

Available in bore sizes from 1 ½ to 8-inch inclusive. Complete engineering drawing of cylinder, mounts, mounting brackets and a capacity chart are included in the new O-M Bulletin 105. This is free on request. Write for your copy today.

ORTMAN-MILLER MACHINE COMPANY
1143rd Street, Hammond, Indiana
Please send FREE bulletin 105
Name_____ Position_____
Company_____
Address_____
City_____ Zone_____ State_____

ONE OF THE GARLOCK 2,000

TRY GARLOCK 663 GASKETS...

dimensionally stable even under varying humidity conditions. With 663 gaskets you can be sure that no matter where your gaskets are stored—in damp cellars or humid tropics—they'll always hold their size and shape . . . and fit just right.

Made from a cork-paper base impregnated with a synthetic rubber, 663 gaskets resist water, oil, and gasoline at temperatures up to 300° F. Also available in sheet form (Style No. 662).

Garlock 663 is approved by Underwriters' Laboratories, Inc., for use against hazardous liquids, such as gasoline, naphtha, benzine, fuel oils, etc.

Sure-fitting 663 gaskets are only one of "the Garlock 2,000" . . . two thousand different styles of gaskets, packings, and seals to meet all your needs . . . the *only* complete line available. That's why you get *unbiased* recommendations from your Garlock representative. Call him today, or write for Bulletin AD-146.

THE GARLOCK PACKING COMPANY,
Palmyra, New York

For Prompt Service, contact one of the 30 sales offices and warehouses throughout the U.S. and Canada.

GARLOCK

Packings, Gaskets, Oil Seals, Mechanical Seals, Rubber Expansion Joints

LETTERS to the editor

is the National Conference on Industrial Hydraulics. For information concerning this Conference, write to Raymond D. Meade, Conference Secretary, National Conference on Industrial Hydraulics, Technology Center, Chicago 16, Ill.

There is also in the United States a National Fluid Power Association which is a trade association for manufacturers of hydraulic and pneumatic components. If you are interested in this type of organization, write to their Executive Secretary, Barrett Rogers, 1618 Orrington Ave., Evanston, Illinois.

Cost of Reclaiming System

I have just finished the article "Reclaiming Fire Resistant Fluids" in the November issue of APPLIED HYDRAULICS which was quite interesting and informative. The cost of the reclaiming system, placed at about $500.00 attracted my attention. It seems a very small cost when the system involves underground lines and a 25-barrel collection pit. In addition, there are the settling tanks, the water-oil separator, the pump, etc., all of which require both initial investment and hand labor. I wonder if some error has been made along the line. Perhaps it would be worth while to check into this matter. We would be very much interested in learning of the results of such a check.

C. R. SCHMITT, Manager,
Lubrication Sales Dept.,
E. F. Houghton & Co.

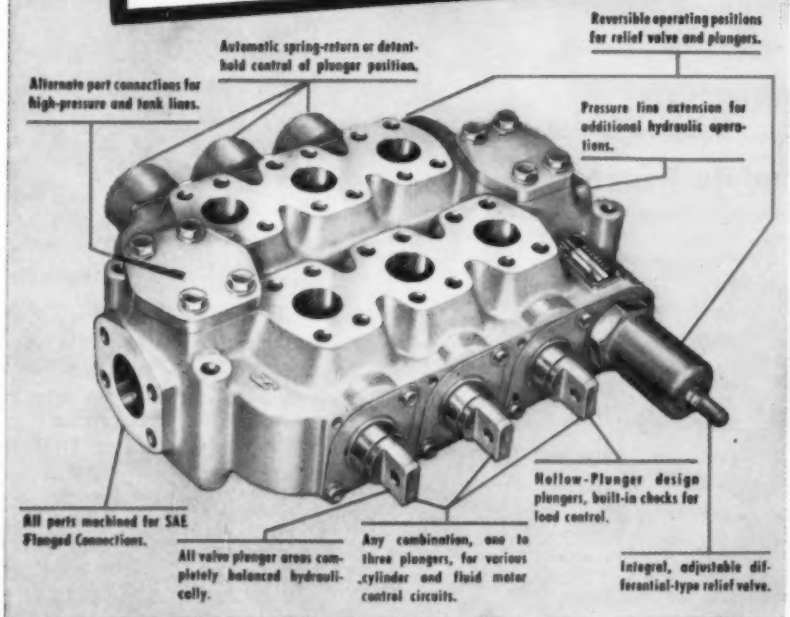
We checked with the source of our information since we did not wish that any of our readers misinterpret the information given in the article. Our understanding that the $500.00 cost covered only the parts listed and not installation or utilization of existing facilities was confirmed. The confirmation, reads, in part: "The $500.00 price covered the installation of equipment to provide ample reclamation upon coverting to a fire resistant

Continued on page 16

BIG VALVES FOR BIG JOBS

A New Series HYDRECO® HOLLOW-PLUNGER CONTROL VALVES

25-50-100 gpm to 2000 psi


Reversible operating positions for relief valve and plungers.
Automatic spring-return or detent-hold control of plunger position.
Alternate port connections for high-pressure and tank lines.
Pressure line extension for additional hydraulic operations.
Hollow-Plunger design plungers, built-in checks for load control.
All ports machined for SAE Flanged Connections.
All valve plunger areas completely balanced hydraulically.
Any combination, one to three plungers, for various cylinder and fluid motor control circuits.
Integral, adjustable differential-type relief valve.

Oil Power for BIG MACHINES

Built-in Checks to prevent load drop while shifting plungers . . . *Improved Throttling* for accurate control . . . *Complete Hydraulic Balance* of all plunger areas . . . this is the BIG NEWS in these new HYDRECO Valves for builders of BIG Machines. HYDRECO *Hollow-Plunger* Valves give hair-line control at *all* times, and, of vital importance with large machines handling heavy loads, there is no load drop when operating positions are changed — no sag, even when power is cut off!

These new HYDRECO Valves make single-acting or double-acting control readily available and provide control for Fluid Motors or for four-position float operation. Relief Valve adjustment and levers can be installed on either side of the Valve.

Member NFPA

Write for complete information on the new HYDRECO Control Valves and companion Hydraulic Pumps for your BIG JOBS.

KALAMAZOO DIVISION
THE NEW YORK AIR BRAKE COMPANY

9004 E. MICHIGAN • KALAMAZOO • MICH.

INTERNATIONAL SALES OFFICE, 90 WEST ST., NEW YORK 6, N. Y.

Fluid Power Speeds Turnpike Construction

CEILING ON CONSTRUCTION EQUIPMENT SIZES LIFTED

Modern turnpike construction calls for moving mountains or filling valleys . . . fast, and at lowest cost. To solve this problem, designers of construction equipment are creating machines that are bigger, faster and easier to handle than was believed possible only a few years ago. With every increase in size, weight and load the problems of operation and control multiply and exceed the ability of conventional hydraulic components to handle the job.

Engineers of The New York Air Brake Company faced this challenge and provided the answer . . . a completely new line of high capacity Gear Pumps and Valves. Today, design engineers can confidently employ circuits requiring up to 100 gpm and 1500 psi; thus lifting the ceiling on size, speed and capacity AND at realistic cost!

One of these big, new machines is the Euclid Model S-18 Overhung Scraper built by Euclid Division, General Motors Corporation, shown here. On this unit, Euclid engineers have specified big HYDRECO Pumps for fluid power and Series V28 HYDRECO Valves for control of scraper operations. A small HYDRECO Pump powers the hydraulic steering circuit. As big as these machines are, HYDRECO Oil Power gives them real "finger-tip" control.

The New York Air Brake Company also offers many other advanced type hydraulic components for designers of heavy-duty mobile equipment . . . DUDCO Dual-Vane Pumps to 150 gpm and 2000 psi; DUDCO and HYDRECO Fluid Motors; HYDRECO Control Valves and Hydraulic Cylinders.

ENGINEERS

Exceptional opportunities for men of imagination to express new ideas in the design and development of Hydraulic Components. Company expansion and progress in this growing industry promise rewarding futures for engineers who qualify. Write, giving experience and full details.

KALAMAZOO Division
The New York Air Brake Company
9004-3 E. Michigan
Kalamazoo, Michigan
Gentlemen:

I would like more information on the *new* HYDRECO Control Valves for BIG Mobile Equipment. ☐ Also details on HYDRECO 3600 Series Pumps. ☐

Name_____ Title_____

Company_____

Address_____

City_____ Zone____ State_____

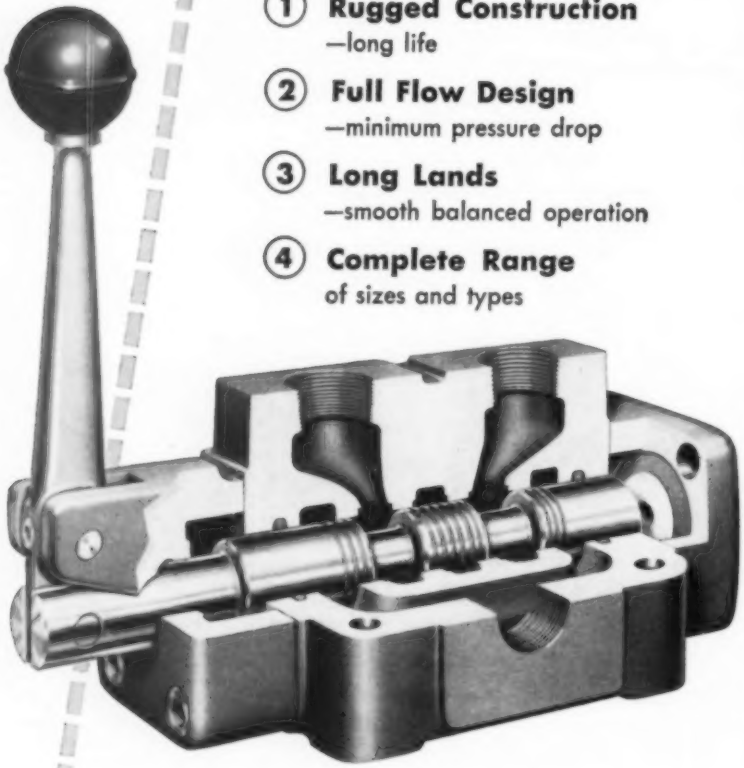
4-way cost control

① **Rugged Construction**
—long life

② **Full Flow Design**
—minimum pressure drop

③ **Long Lands**
—smooth balanced operation

④ **Complete Range**
of sizes and types



H-P-M Directional Control Valves meet most demands for unqualified heavy-duty service. That's why economy minded design engineers choose time-tested, job-proved H-P-M hydraulic valves and controls for every hydraulic requirement in the 2000-3000 psi range. Heavy distortion-free bodies, smooth operating spools, wide choice of operating characteristics are available. Write today for complete catalogs—¼" to 4" sizes.

HPM

HYDRAULIC POWER DIVISION
THE HYDRAULIC PRESS MFG. CO.
Mount Gilead, Ohio, U.S.A.

LETTERS to the editor

fluid. The cost involved at a price of $500.00 was the water-oil separator, the three 55-gallon drums used as setting tanks and the associated piping and pumps. The individual sumps at the machines along with a six-inch sewer connecting line and the collecting pit were in place previously at the Hardy plant.

We appreciate the opportunity to clear up this situation."

M. C. PLUMMER,
Sales Engineer
Functional Fluid Sales
Monsanto Chemical Co.

Needs a Source of Fluid Motors

The hydraulic motors we want will be coupled with pumps which deliver 12 gpm at 1000 psi. The motor should be capable of producing about 7 hp at a maximum speed of somewhere between 1700 and 3000 rpm. We expect to require a steady supply of these hydraulic motors once they have proven themselves in field tests for our application.

RONALD O. FARR
Savell Equipment Co.
Brunswick, Me.

There are a number of manufacturers who supply piston, vane or gear motors which can supply your volume, speed and pressure demands. A list of manufacturers taken from our Master Catalog of Fluid Power Products has been sent to you.

Magnetic Plugs and Filters

Would you please tell me where I may obtain magnetic plugs and filters for installation in hydraulic systems. I believe they would be the answer to some of our problems.

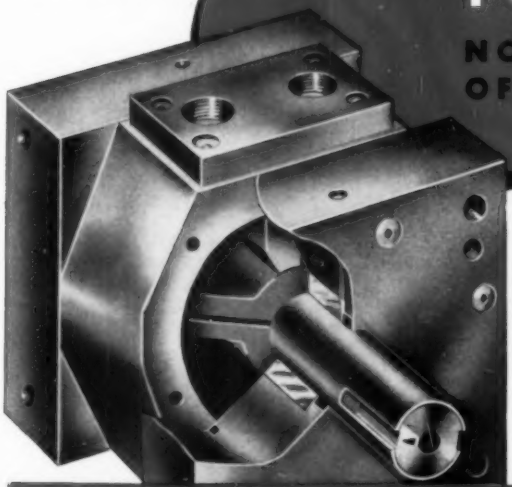
D. G. H. STEVENSON
Aluminum Co. of Canada Ltd.
Kitimat, B.C. Canada

Addresses of several sources of supply have been sent. ▼▼▼

SEE US AT BOOTH 724 ASTE EXPOSITION

New ROTO-MATION TORQUE MOTOR

NOW OFFERS 4 COST-CUTTING ADVANTAGES



For Oil or other Pressure Mediums.
Pressure Against Vane Reciprocates Shaft.

TYPICAL TORQUE RATINGS (IN.-LBS.)
Single Vane Units—280° Arc both directions

BORE SIZE	Vane Length	100 PSI	500 PSI	1000 PSI	WT. LBS.
3"	2"	150	750	1500	15
	4"	300	1500	3000	21.5
	6"	450	2250	4500	28
6"	3"	1000	5000	10,000	92
	6"	2000	10,000	20,000	104
10"	5"	5000	25,000	50,000	286
	8"	8000	40,000	80,000	312
	12"	12,000	60,000	120,000	387
20"	6"	30,000	150,000	300,000	1620
	12"	60,000	300,000	600,000	2100

NOTE: Double Vane Units double torque with same pressures, but rotation is limited to 100° in both directions.

✓ **HIGHER TORQUE OUTPUT**—special neoprene and teflon vane seals minimize leakage . . . insure greater power. Speeds limited only by fluid pressure volume. Full torque power obtainable in fraction of a second.

✓ **GREATER OPERATING EFFICIENCY**—through superior design of special vane seals and close tolerance fitting of all parts. Operates at 95 to 98% efficiency, withstands heat up to 200°F. Special models and seals for higher temperatures.

✓ **SIMPLE, ECONOMICAL APPLICATION**—eliminates complex linkages, sprockets, chains, cylinders. Saves space. Applicable to turning, opening, closing, clamping, indexing, feeding, pushing, or moving any type of load or mechanism.

✓ **LONGER SERVICE LIFE**—fewer moving parts, precision machined components, bronze nut and thrust bearings, chrome vanadium and chrome-moly steel shafts. No external leakage.

COMPACT, RUGGED, ADAPTABLE TO A WIDER RANGE OF APPLICATIONS

The new ROTO-MATION Oscillating Torque Motor is a simple, more versatile hydraulic-pneumatic device especially designed to produce more torque power (1,800,000 in.-lbs. from 20" bore) to serve a wider variety of automation applications. Compact and rugged, the new motor is easily adaptable to original equipment or as a replacement unit. Wide ports and flange-type connections meet J.I.C. standards. Extensive tests prove that performance life is many times greater than any device previously manufactured. The square shape facilitates easy mounting on any of six faces. There are 14 mounting models available and four shaft styles. Units are complete with standardized controls, fittings, and auxiliary devices. Sizes are available for moving loads ranging from a few ounces to many tons.

Write **FOR COMPLETE SPECIFICATIONS**—New catalog provides complete specifications, illustrates and describes wide variety of applications, and contains complete torque load graphs.

ROTO-MATION INC.

NOW A SUBSIDIARY OF PINES ENGINEERING CO., INC.

943 E. SATER STREET • GREENVILLE, OHIO

MANUFACTURERS OF ROTO-MATION MOTORS, CONTROLS, AND AUXILIARY TRANSMISSION EQUIPMENT

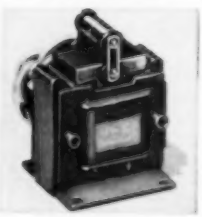
- Up to 30 pounds force. Push or pull.
- Full one inch stroke available.
- Decco shock-mounted for long life.
- High efficiency—silicon steel laminations.
- High moisture resistance.
- Shock absorbing bumpers cushion stroke.

Decco

SERIES 50

INDUSTRIAL SOLENOIDS

Your choice of mounts



Push or pull types

Direct current solenoids

Decco's Series 50 offers more power—longer stroke with the same dependable quality and performance that has made Decco the top name in industrial solenoids.

There is a Decco solenoid for every requirement. Built to give better service for a longer time. Solenoids engineered and modified to your requirements. Let us discuss your problems.

For complete information write—

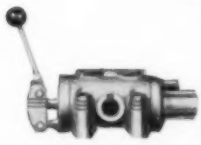
Decco SOLENOIDS THE HEART OF DEPENDABLE AUTOMATION EQUIPMENT

DETROIT COIL COMPANY

2435 HILTON ROAD, FERNDALE 20, MICHIGAN

"Why is it easy to plan Hydraulic Circuits using **RIVETT VALVES?**"

COMPLETE LINE



Hand, Foot, Cam, Solenoid, Pilot Operated

Sub-Plate Mounted, Solenoid, Pilot Operated

Flow Control, Check, Deceleration, Relief, Unloading, Sequence, Counter-Balance

1500-3000 P.S.I. | PISTON DESIGNS FOR ANY CIRCUIT

Sizes: 1/4", 3/8", 1/2", 3/4", 1", 1-1/4", 1-1/2"

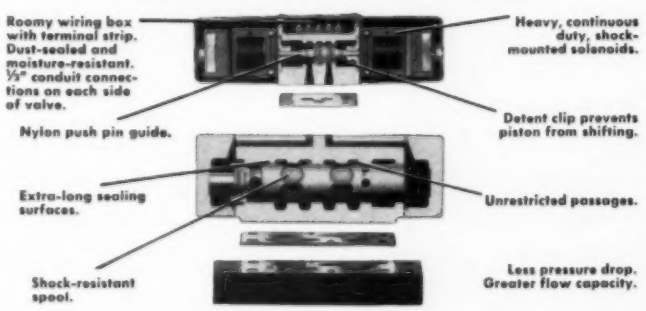
Actions: Standard, Spring Return, Spring Centered, Ball Detent

EXPERIENCED DISTRIBUTORS

"1st — Rivett's 190 standard models give me more latitude in engineering a circuit. This wide selection permits choosing the right type of valve for a more economical and efficient operation."

"2nd — My Rivett Distributor is experienced in hydraulic design. With his help I have been able to plan better operating systems."

QUALITY CONSTRUCTION


Roomy wiring box with terminal strip. Dust-sealed and moisture-resistant. ½" conduit connections on each side of valve.
Heavy, continuous duty, shock-mounted solenoids.
Nylon push pin guide.
Detent clip prevents piston from shifting.
Extra-long sealing surfaces.
Unrestricted passages.
Shock-resistant spool.
Less pressure drop. Greater flow capacity.

Sub-Plate Mounted, Solenoid, Pilot Operated Valve

INFORMATIVE LITERATURE

"3rd — I can count on longer life as well as the rated performance of Rivett Valves. They are designed and built for accurate circuit control."

"4th — Rivett valve catalogs are complete with specifications and drawings. Write for #204 and #260."

RIVETT LATHE & GRINDER, INC., DEPT. AH-3 BRIGHTON 35, BOSTON, MASSACHUSETTS

RIVETT **furnishes a complete power package**

AIR AND HYDRAULIC — VALVES, CYLINDERS, POWER UNITS

See Rivett Valves at Booth 324, ASTE Show, Chicago, March 19-23.

BRIEFS about fluid power

TOOLING DEVELOPMENT CUTS LEAKS 500%

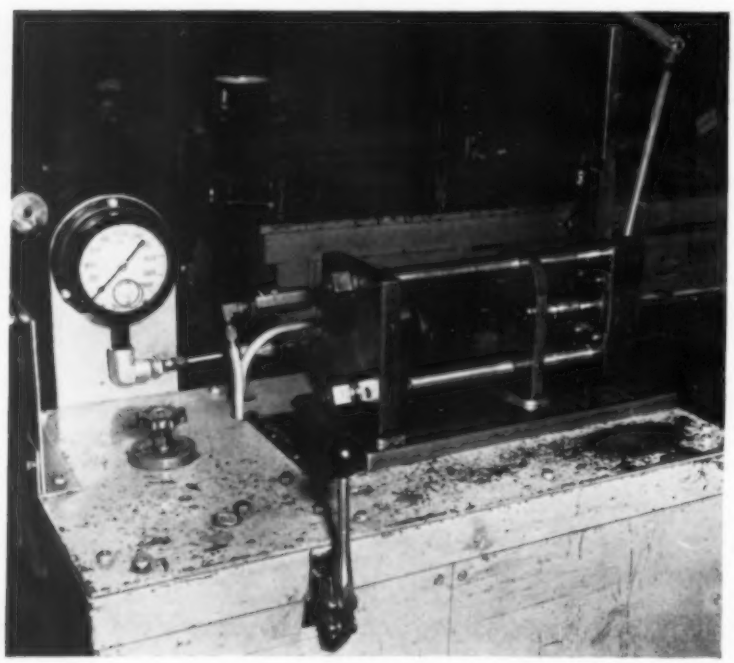
Chance Vought Aircraft tool enginners have developed a system of presetting hydraulic tubing sleeves which has reduced hydraulic leaks at tube joints 500% under bench tests. Emil V. Block, senior tool research engineer at Chance Vought, reports that early problems in the development of this tooling involved selection of a proper motor driven pump and selection of abrasive-resisting tool steels for the dies which work against the cyanided sleeves.

Control of the amount and the location of bulging inside the tube also was a problem. For medium thick-walled alumium tubing a slightly tapered mandrel was sufficient, but for thin-walled stainless steel tubing a stepped mandrel was developed which formed a bulge that was more abrupt at the forward edge. This insured a surface more favorable for cutting edge contact.

Another phase of the project called for heavy-walled aluminum tubing to replace thin-walled stainless steel tubing. This called for changes in tooling, operating pressures and inspection equipment. The first discovery in pre-setting aluminum was the necessity of shortening the tube and projection to allow proper sealing of the fitting. In presetting sleeves on thin-walled stainless steel tubing, the end projection was long enough to reach into the angle of the fitting. For aluminum, the end projection had to be shortened to completely clear the top of this recess.

It was found that when tightening the sleeved tube in the fitting, if the tube touched the recess end it would prevent the sleeve from sealing properly. New mandrels were designed for the swaging dies. These mandrels do not project into the I.D. of the tube, the wall thickness being sufficient to prevent excessive bulging, and were used only to control end tube projection.

Research is still underway on use of a new double-ended sleeve and short nut. This type sleeve and nut is considered to be weight saving and to have higher fatigue properties. First tryout of the assembly will be on the 3/16 diameter size tube used on the gun charging line. It is believed this sleeve can be incorporated with only minor changes in tooling and procedures. Illustration shows hydraulic-powered preswager. Tube being swaged, clamp handle and split blocks are at the right. ▼▼▼



Continued on page 22

OUR IDEA WAS TO BUILD A BETTER VALVE...
Seemed like a sound one to us.
Machines and methods had improved. Automation came along. But air valves had been basically unchanged for twenty years. Too bulky, too complicated, too difficult to service, in our estimation.
So, here at MAC—we simplified air valve design.
Instead of twenty or thirty parts, we engineered a valve with just eleven. Only one moves—the spool—so there's only one to wear. Our valve is lightweight—eight pounds, instead of ten to eighteen. And smaller. The ½" 4-way MAC solenoid air valve, for example, is just 3"x3"x7"—about the size of a pound of butter.
It's the easiest valve we know of to service. You can get at the spool by simply removing the retainer. No need to touch the piping at all. For that matter, a MAC valve seldom requires maintenance. On the toughest jobs, our valves have run for millions of cycles without being touched, thanks mainly to precision workmanship with only the most reliable of materials and the quality checks every valve must pass before it leaves our plant.
If you like the idea of simplicity in valve design—better performance at lower cost—get in touch with us. Nothing will please us more than to have you compare MAC valves. We'll be happy, also, for the chance to lend our "know-how" to any air control application you have in mind.
No obligation, of course. Write us now.
MECHANICAL AIR CONTROLS, INC.
10030 Capitol, Oak Park, Detroit 37, Michigan
MAC
AND THE VALVE SEAL IS
sirvene

WHEN YOU DEMAND CRITICAL PRECISION

Only one part . . . the spool . . . moves in this ingenious MAC 4-way air valve. It's an oscillation that must be critically precise . . . and is. The C/R Sirvene (synthetic rubber) parts seal the valve circuits under pressures up to 150 psi and over a wide range of temperatures and cycle speeds. To operate correctly, those small Sirvene parts must be molded to unusually close dimensional tolerances. C/R is consistently meeting . . . and beating these tolerances. And MAC reports that on the toughest jobs their valves have run for millions of cycles without trouble.

You can have the same dependability. Whenever your mechanism design demands the most exacting qualities in a molded pliable part . . . depend on Sirvene. As a start—write for your copy of the new "Sirvene" booklet.

SIRVENE C/R DIVISION
CHICAGO RAWHIDE

CHICAGO RAWHIDE MANUFACTURING COMPANY
1203 Elston Avenue, Chicago 22, Illinois

Offices in 55 principal cities • See your telephone book

In Canada: Manufactured and Distributed by Super Oil Seal Mfg. Co., Ltd., Hamilton, Ontario

Export Sales: Geon International Corp. Great Neck, New York.

Other C/R Products

C/R Shaft and End Face Seals • Sirvis-Conpor mechanical leather cups, packings, boots • C/R Non-metallic Gears

put the pressure on

FLEX-O-TUBE®

If pressure is a factor in the performance of your product, you can rely on Flex-O-Tube. For here is a name that has stood for uniformity of high quality for twenty-five years.

And just as important, the Flex-O-Tube organization is one that you can rely on, too. When the pressure's on for production you can count on prompt deliveries of flexible hose products that consistently meet specifications.

These are but two of the reasons why industry has used miles and miles of Flex-O-Tube and continues to specify it in increasing quantities. Why don't you find out for yourself by "putting the pressure on Flex-O-Tube"?

Supplied in Assemblies

Flex-O-Tube will help you determine the assembly needed or work to your own specifications. In either case, modern facilities and latest inspection techniques assure you a uniformly high quality product delivered promptly.

Supplied for Field Assembly

Flex-O-Tube hose is also supplied in bulk coils with reusable fittings for field assembly. Complete range of sizes and types.

Please send me your free ☐ aircraft catalog. ☐ industrial catalog.

Name .....

Company .....

City ..... Zone ..... State .....

Address .....

FLEX-O-TUBE

DIVISION OF MERIDAN CORP.

2527 JIM DALY ROAD • INKSTER, MICHIGAN

Flex-O-Tube Co. (Canada) Ltd., Windsor, Ontario

BRIEFS continued

Judges for 1956 Prize Paper Contest

Three outstanding engineers, representing the automotive, mobile equipment and aviation industries, have accepted the invitation to act as judges for this year's APPLIED HYDRAULICS Prize Paper Contest.

F. C. Schuster
Buda Division
Allis-Chalmers Mfg. Co.

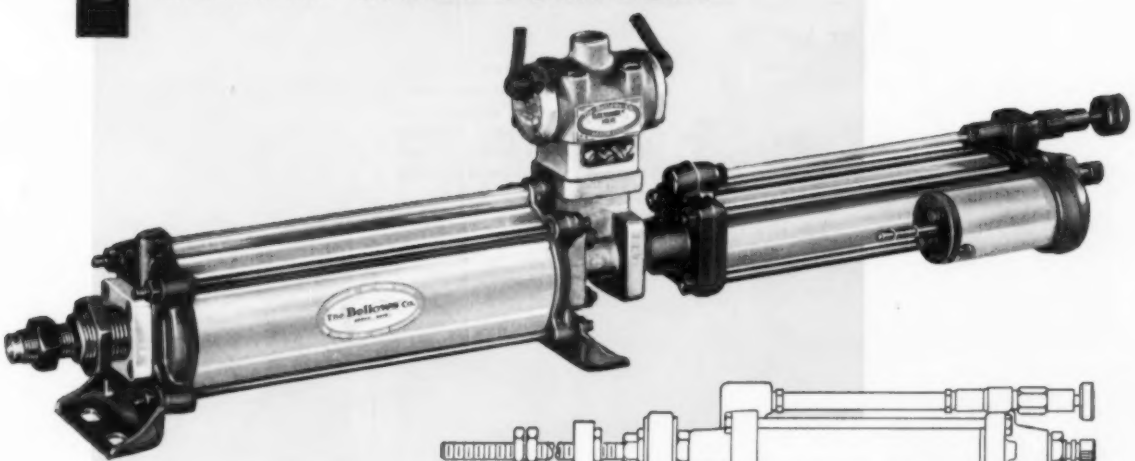
• **F. C. Schuster,** chief engineer of the Industrial Truck Division, Allis-Chalmers Manufacturing Co.—Buda Division, Harvey, Ill., is a veteran designer in the lift truck field. After graduation he served a tool design apprenticeship at the International Harvester Co. and attended evening classes at Illinois Institute of Technology and the Armour Institute. While employed by Automatic Transportation Co., from 1936-1951, he was closely associated with the introduction and development of high pressure hydraulic systems for lift truck operations. At Buda Mr. Schuster has been responsible for the development of a new line of lift trucks which incorporate hydraulics in many phases.

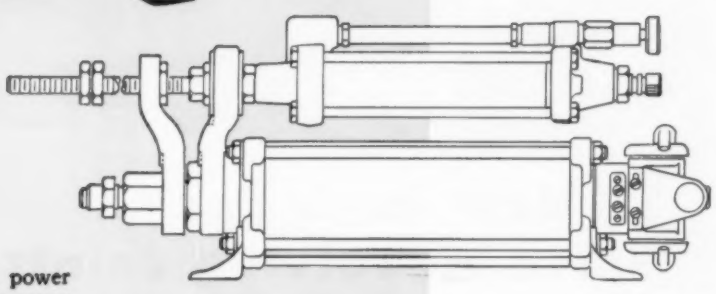
• **J. J. Yates,** electric and hydraulic engineer, Detroit Diesel Engine Division, General Motors Corporation, graduated from Notre Dame in 1929 with a B.S. in Electrical Engineering. Associated with the company for 14

Continued on page 24

This AIR CYLINDER features—

1 **BUILT-IN *HYDRAULIC CONTROL***
2 **BUILT-IN *ELECTRIC CONTROL***
3 **BUILT-IN *SPEED CONTROLS***





In one compact packaged power unit are built-in controls to cover every phase of air cylinder operation. Built-in hydraulic control of piston rod movement gives the smoothness characteristic of hydraulic operation, yet retains the speed and flexibility of air power. Built-in electrically controlled directional valve permits quick, positive, push button remote control, or easy electrical synchronization with other machine elements. Built-in speed controls permit exact control of piston rod speed in either or both directions.

This combination of Bellows Air Motor and Hydro-Check is available in five bore sizes: 1¼", 1¾", 2½", 3⅝" and 4½" in standard stroke lengths up to 18".

Here is air cylinder power at its best—fast, flexible, safe, and smooth.

BULLETIN ML-3 TELLS THE STORY. WRITE FOR IT TODAY!
DEPT. AH356

The Bellows Co.

AKRON 9, OHIO

TWO MOUNTING STYLES

The Bellows Air Motor and Hydro-Check (Model HCB-EM) is available arranged in tandem as shown above, or in parallel, as sketched.

●

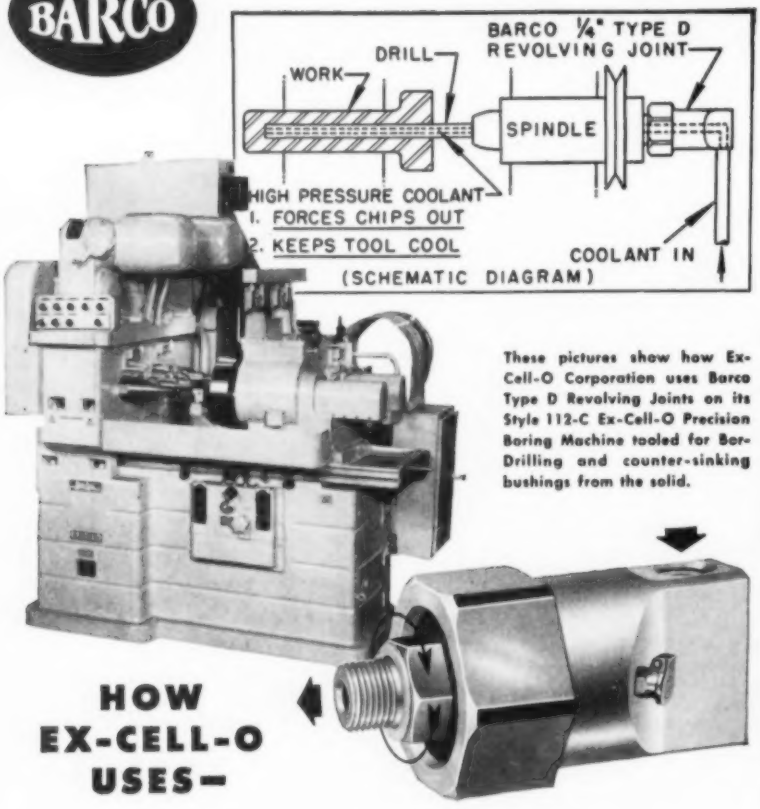
Combination units of Air Motor and Hydro-Check are also made with any one of six other Bellows directional valve arrangements; and, of course, Air Motors and Hydro-Checks are available as separate units.

Controlled Air-Power

FOR FASTER, SAFER, BETTER PRODUCTION

1361-A

BARCO



These pictures show how Ex-Cell-O Corporation uses Barco Type D Revolving Joints on its Style 112-C Ex-Cell-O Precision Boring Machine tooled for Bor-Drilling and counter-sinking bushings from the solid.

HOW EX-CELL-O USES—

New High Speed Barco Revolving Joints
for speeds up to 10,000 RPM

BARCO'S new, high speed Type D Revolving Joints are especially designed for machine tool installations. Ex-Cell-O Corporation uses them to introduce coolant under high pressure through the spindles and Bor-Drills of the machine shown above to force out chips and keep the drills cool (see sketch). Barco's Type D Joints are well-suited for this application because of their precision construction and compact design. Exclusive seals are self-adjusting for wear and permit operating speeds as high as 10,000 RPM on coolant service. Joints can be used on pressures to 300 psi (air) or 1500 psi (hydraulic). Temperatures from −20° to +225°F. For complete information, write BARCO MANUFACTURING CO., 532D Hough Street, Barrington, Illinois.

BARCO

THE ONLY TRULY COMPLETE LINE OF FLEXIBLE BALL, SWIVEL, SWING, AND REVOLVING JOINTS

BRIEFS continued

years, he has been engaged for nearly ten of these in hydraulic and electrical design work. Mr. Yates has been active in the development of the JIC Electrical Standards for Industrial Equipment. He is chairman of the Electrical Subcommittee on Electrical Equipment for GM.

H. A. Campbell
Bell Aircraft Corporation

• **H. A. Campbell,** head of General Engineering Laboratories, Bell Aircraft Corporation, Buffalo, since 1950, has spent his entire professional career in the aviation field, mostly as a designer and research engineer. A graduate of Pennsylvania State College, Mr. Campbell was electrical design group leader for Consolidated Aircraft Corporation from 1929-1939. For several years he was manager of research and chief metallurgist for Solar Aircraft Company. During this period he served on the Aviation Technical Committee, A.I.E.E. and the Technical Advisory Committee on Aero Steels. He is now active on committee work for AIA and ASTM.

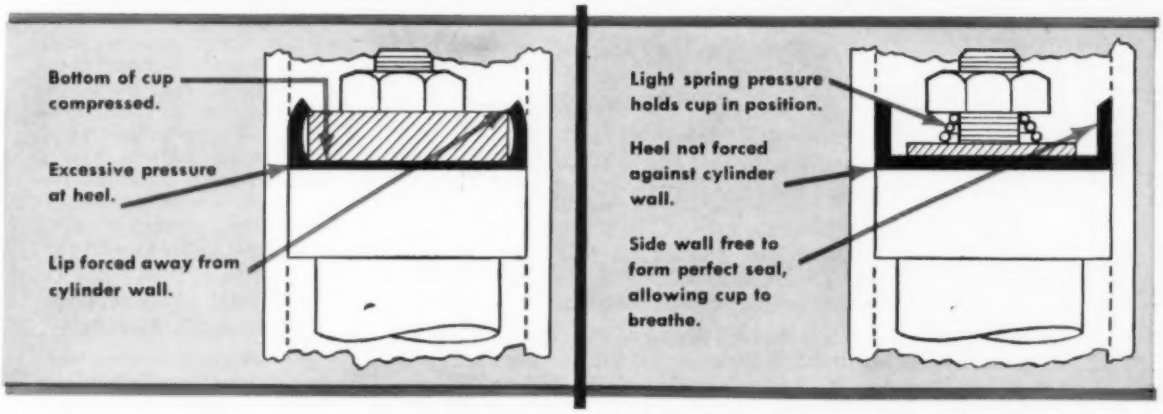
Anyone who uses, designs, builds or maintains fluid powered machines or equipment can enter this contest. All papers winning cash awards and given honorable mention will be published. Each entry will be evaluated on the basis of practicality, economic value, originality and presentation. For details see page 137. ▼▼▼

Continued on page 28

ANOTHER
NEW DEVELOPMENT
IN PACKING DESIGN

SPRING MOUNTED CUPS

Provide Better Seal.....Reduce Friction


Bottom of cup compressed.
Excessive pressure at heel.
Lip forced away from cylinder wall.
Light spring pressure holds cup in position.
Heel not forced against cylinder wall.
Side wall free to form perfect seal, allowing cup to breathe.

Houghton hydraulic research has come up with one of the chief answers to the problem of excessive friction, short cup life and chatter so often encountered in cup packing installations. Now, instead of the squeezing action of bolting the cup packing in place between the piston and the follower plate, you can use a spring mounting with preformed cup packings. The illustrations show the obvious advantages.

This leadership in hydraulic know-how is typical of Houghton, which makes all types of hydraulic and pneumatic packings, as well as a complete line of hydraulic oils and fluids.

Standardize on Houghton. You'll get the newest first—and the best always. Call your Houghton Man. He will explain their Hydraulic Service. E. F. Houghton & Co., 303 West Lehigh Avenue, Philadelphia 33, Pa.

. . . products of

E. F. HOUGHTON & CO.
PHILADELPHIA · CHICAGO · DETROIT · SAN FRANCISCO

Ready to give you on-the-job service . .

Circle 67 on Reader Service Card

Pumping Progress Report

FOR MECHANICAL ENGINEERS

An advertisement prepared by the Aldrich Pump Co., Member of Hydraulic Institute, U.S.A.

PUMP INSPECTION, MAINTENANCE AND REPAIR are jobs too frequently ignored in the design of production pumps. This has been verified by a survey of more than 15,000 pump installations. Speed and economy of maintenance was frequently quoted as a major factor in pump selection.

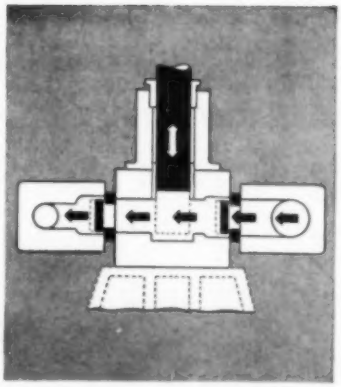
SECTIONALIZED FLUID-ENDS offer one of the best ways to guarantee both speed and economy in pump maintenance. As originated by ALDRICH Pump Co. Engineers, the Sectionalized Fluid-End comprises four main assemblies — the working barrel, suction manifold, discharge manifold and stuffing box.

SPEED IN MAINTENANCE is assured because of ease of accessibility of all wearing parts. Manifolds can be slid back on studs and valves removed as complete units. Split collar and flange connection of plunger to yoke permits easy removal of plunger.

ECONOMY OF MAINTENANCE results from speed in maintenance. Perhaps even more important is the simple fact that it is cheaper to replace a single section than a complete fluid-end. Another important economy is parts interchangeability. Among 3-, 5-, 7- and 9-plunger units of any series, wearing parts are interchangeable. Where a combination of multiplex pumps is required, this reduces spare parts stocks.

THE ALDRICH PUMP COMPANY is the originator of the DIRECT FLOW principle — a design innovation that utilizes the sectionalized fluid-end principle. Aldrich Engineers have become known as the people to take your tough pumping problems to. We have never turned down a challenge.

FURTHER INFORMATION can be had direct from the company. Tell us your problem and we'll send you Data Sheets describing the size pump we recommend to solve your problem. Address your request to: The Aldrich Pump Company, 14 Gordon Street, Allentown, Pa.



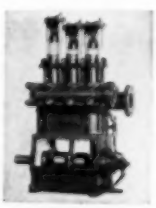
Aldrich Direct Flow Fluid-End Design

...for your tough pumping problems specify ALDRICH

The Direct Flow principle, an Aldrich design innovation, is a major forward step toward the solution of tough pumping problems of all kinds. Not only does it eliminate two right-angle turns in the fluid-end, but in addition makes possible complete Fluid-End Sectionalization. This is another Aldrich design innovation which permits economies of maintenance and repair offered by no other type pump.

CHECK THESE ADVANTAGES OF SECTIONALIZED FLUID-ENDS:

Less expensive parts replacement
Ease of inspection and maintenance
Interchangeable wearing parts
No special equipment for valve removal
Easily accessible stuffing boxes



Write today for Data Sheets describing the Direct Flow Pump Series.

THE ALDRICH PUMP COMPANY

Originators of the Direct Flow Pump
14 GORDON STREET
ALLENTOWN, PA.
Representatives in principal cities

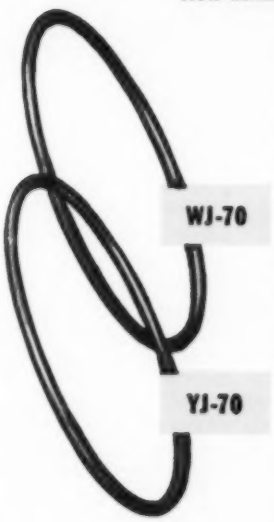
Circle 7 on Reader Service Card

Elevated Temperatures

Destructive Fluids

Costly Leaks

New LINEAR Compounds Answer Difficult Sealing Questions



Through pioneer research in the utilization of new polymers and elastomers, LINEAR provides new answers to problem sealing applications in hydraulic systems.

Smashes through the thermal barrier! At elevated temperatures, conventional ring packing compounds cannot withstand *Aromatic Fuels, Aroclor, Dow-Therm-A, MIL-L-7808* and other diester fluids. LINEAR "O" Rings molded with WJ-70 compound, were tested up to 78,000 cycles at 500°F. They show absolutely no sign of deterioration . . . no change in the precise dimension of the rings!

Withstands both flammable and non-flammable fluids! LINEAR homogeneous molded parts including "O" Rings, V Rings, Cups or Fabric Reinforced Vee-Dam Rings compounded from YJ-70 provide perfect sealing in hydraulic systems using such fluids as *Skydrol, Pydraul, Lindol,* or mediums that contain *Tri-Cresyl-Phosphate.* In these, as well as in flammable petroleum base fluids, YJ-70 resists deterioration . . . makes packing changeovers unnecessary, regardless of the fluid used.

These new LINEAR compounds have widespread industrial application—may help solve a difficult sealing problem for you. They are additional examples of why it pays you to rely on LINEAR'S experience.

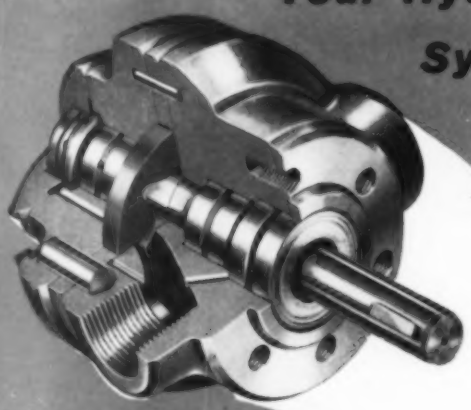
"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

Circle 88 on Reader Service Card

How to Engineer Dependability Into Your Hydraulic System....



Specify Gerotor Hydraulic Pumps

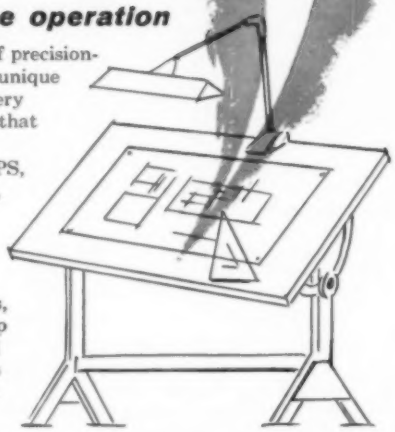
Years of trouble-free operation

are yours with the GEROTOR line of precision-manufactured hydraulic pumps. The unique GEROTOR principle . . . heart of every GEROTOR pump . . . is so designed that friction is reduced to a minimum.

GEROTOR HYDRAULIC PUMPS, designed into your hydraulic systems, assure lower maintenance costs over longer life. Standard GEROTOR pumps are available in capacities ranging from .4 g.p.m. to 40 g.p.m.

Due to modern production facilities, GEROTOR can produce special pump designs in *quantities* on an economical basis. Whatever your hydraulic pump problems, bring them to GEROTOR.

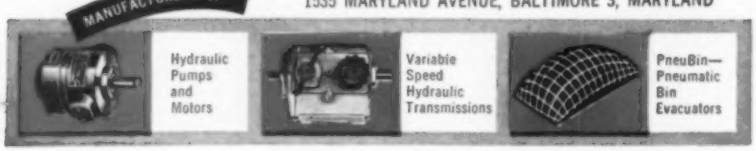
FREE literature available . . . *write:*



GEROTOR
MAY CORPORATION

MANUFACTURERS OF—

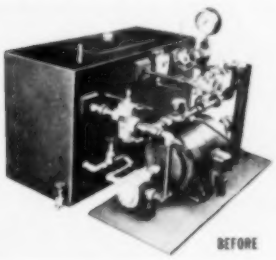
1535 MARYLAND AVENUE, BALTIMORE 3, MARYLAND

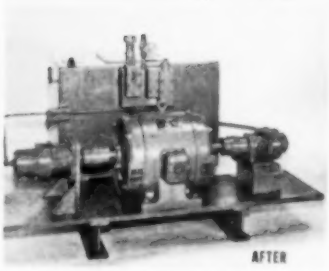


BRIEFS continued

Hydraulic Circuit Eliminates Exposed Piping

Designed to prevent burst hydraulic lines, Clifton Hydraulic Press Company, Clifton, N. J., has developed a new type hydraulic circuit, known as Unitrol, on electrically driven hydraulic power units. Oil passages which are drilled in a steel block eliminate up to 40 feet of exposed piping. Previously a single faulty valve required dismantling much of the associated piping, while on the new system the valve can be removed simply by unscrewing the four bolts which fasten the face plate to the block. Illustration shows power units before and after Unitrol installation. ▼▼▼

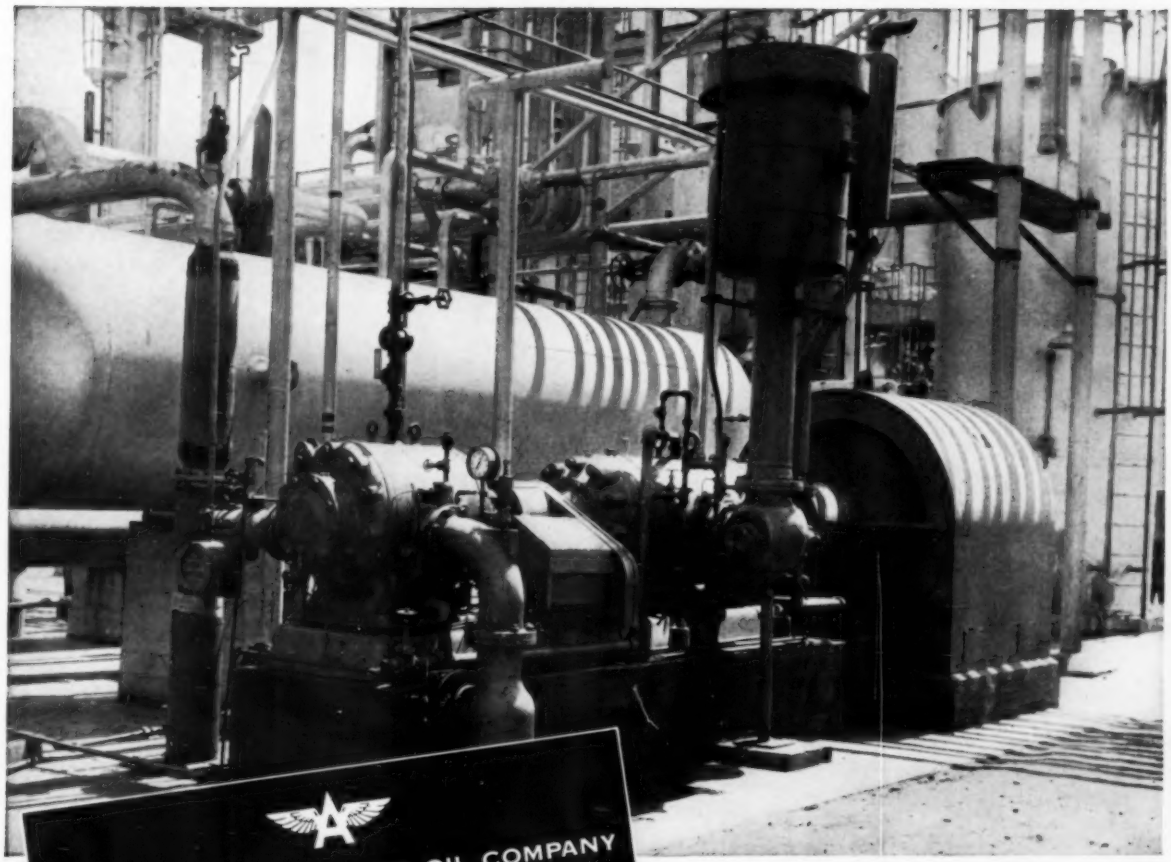

BEFORE


AFTER

Fluid Power Merchandising Manual

What a manufacturer can do to supply his sales representatives with complete information is emphasized by a giant manual prepared by Modernair Corporation. The manual is designed to help their sales representatives to know their products, how and where to apply them, what they can and cannot do to benefit each particular prospect. Here's a mammoth

Continued on page 30



installs fuller rotary compressors in its Avon Refinery

When Tide Water Associated needed additional air for various operations in its Avon plant, its engineers investigated the possibilities of the Fuller Rotary Compressor. After making a thorough study of its merits, Tide Water purchased and installed two C-300-300H two-stage units, each supplying 1598 c.f.m., 100-lb. air for general plant use, one of which is shown above. Note that this machine is installed out in the open with no protection from varying weather conditions, operating 24 hours per day, seven days a week.

These two-stage machines are located in different departments of the plant to best meet the air-load requirements of the particular department being served.

Tide Water also has installed in this same plant, two C-300 Fuller Rotary single-stage compressors with a capacity of 1542 c.f.m. each, at 40-lb. pressure, used in the catalyst-cracking process.

Hundreds of Fuller Rotaries are serving the petroleum industry, proving their worth for general plant air, purging gas, refrigeration in alkalization units, and handling butane-butylene in the refinery, as well as in the field for pressure boosting and gas gathering.

Simplicity of construction has proved to be one of the important factors—no valves to leak, no seats to grind, results in maintained capacity for the life of the machine; simplified drive eliminates power transmission losses. For full information write us for Bulletin C-5A.

Fuller
. . . . pioneers in harnessing AIR

FULLER COMPANY 142 Bridge St., Catasauqua, Pa.
GENERAL AMERICAN TRANSPORTATION CORPORATION SUBSIDIARY
Chicago · San Francisco · Los Angeles · Seattle · Birmingham C-272 1572

CHEMLON... *the Teflon* solution to your*

hydraulic cylinder packing problems

lasts longer in all hydraulic services including non-flammable and synthetic fluids

Once and for all . . . John Crane Chemlon Piston Cup, U-Cup and Flange Packings are the answer to handling *all* types of hydraulic fluids. Molded from chemically inert Teflon, they give positive sealing and long-lasting performance not possible with leather, fabric-reinforced or similar packings.

Heat will not cause these packings to shrink away from the cylinder walls or rod. They will not harden, shrink, swell or in any way disintegrate under higher temperatures often encountered in hydraulic service. Their exceptional thermal characteristics provide an operating range from −94°F. to +350°F.

Here . . . in a wide range of sizes or fabricated to your individual specifications . . . is a complete line of hydraulic packings to meet the need of any operating requirement.

Write to "John Crane" Send now for bulletin giving full technical and application data. Crane Packing Company, 6405 Oakton Street, Morton Grove, Illinois, (Chicago Suburb). *In Canada: Crane Packing Co., Ltd., Hamilton, Ont.*

**DuPont Trademark*

JOHN CRANE **CRANE PACKING COMPANY** 38 YEARS INDUSTRIAL PROGRESS

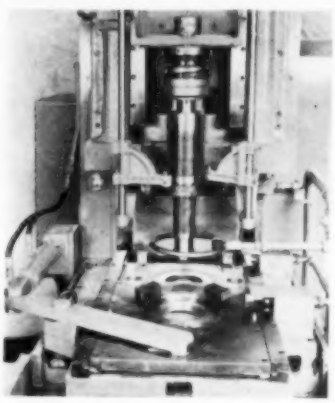
OFFICES IN ALL PRINCIPAL CITIES

BRIEFS continued

job carried out by the manufacturer to fully acquaint his salesmen with the fluid power market, the thinking behind the advertising and production programs, the use of training aids and available technical literature. ▼▼▼

Hydraulically Operated Loading Device Boosts Ring Gear Production

Addition of a hydraulically driven, shuttle-type loading and unloading fixture to a standard pull-down broaching machine, has increased production to 300 gear blanks per hour. Engineers at Colonial Broach & Machine Company, Detroit, were able to add this device without making any changes in the basic design.

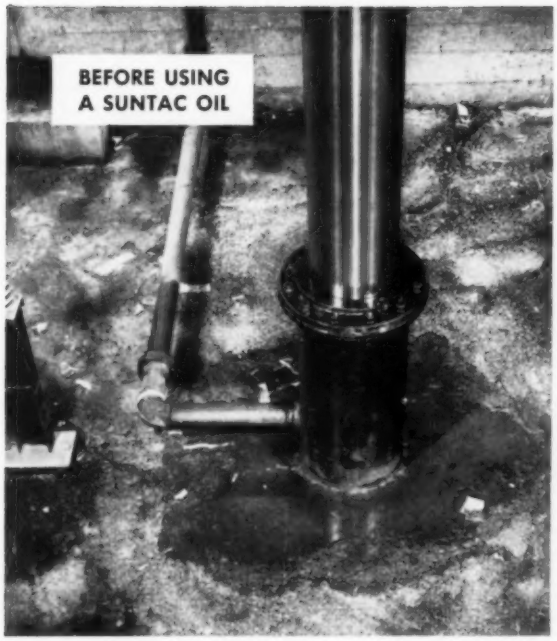


This shuttling fixture is mounted on the work holding platen and only locates the part with respect to the broach. Machine and fixture cycle are hydraulically and electrically interlocked for automatic operation. ▼▼▼

Industry Joins To Evaluate Research Projects

The Research Fund Committee of The American Society of Tool Engineers will have steering committees composed of members representing suppliers, users and interested technical groups of an in-

Continued on page 32



SUNTAC CUTS OIL WASTE, MAINTENANCE COSTS

High quality Suntac oils reduce drip...throw-off...squeeze-out... cut leakage an average of 35% and up to 90% in some cases.

Before using Suntac oil, a prominent eastern manufacturer had to add excessive make-up oil to the hydraulic system of his freight elevator. Oil leakage caused a continual housekeeping problem...the pit had to be cleaned out every six to eight weeks and maintenance costs were high.

Now, one year after switching to a Suntac oil, make-up has been drastically reduced, and frequent pit clean-ups are no longer necessary.

The reason: Suntac oils are specially compounded oils with adhesive-cohesive characteristics that enable them to cling to parts where other oils would drip, throw-off, leak, and squeeze out.

For complete information about Suntac oils, see your Sun representative, or write SUN OIL COMPANY, Philadelphia 3, Pa., Dept. AH-3.

SUNOCO®

INDUSTRIAL PRODUCTS DEPARTMENT

SUN OIL COMPANY, PHILADELPHIA 3, PA.

IN CANADA: SUN OIL COMPANY, LTD., TORONTO AND MONTREAL

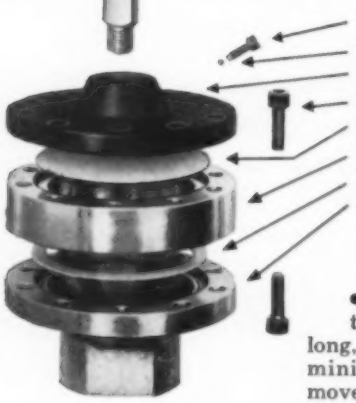
an ACCO product

Helicoid Chemical Gage

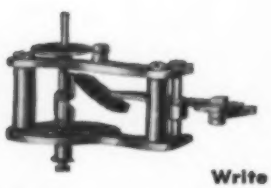
Gages for corrosive chemicals and liquids up to 5000 p.s.i.

• Here's an accurate pressure gage for chemicals and other viscous liquids which might corrode or clog the Bourdon Tube. It registers working pressures from 30″ vacuum to 5000 p.s.i. and temperatures to 400° F. Guaranteed accuracy plus or minus 1%. A single diaphragm seals off objectionable substances from the indicating gage. This gage is filled completely with specific inert liquids and pressure is transmitted directly to the indicating gage through deflection of the sealing diaphragm.

FEATURES



• HELICOID GAGES cost less in the long run because they give long, trouble-free service with a minimum of maintenance. The movement is a simple cam and roller design that does not have any gear teeth to wear out. It has been tested and proved in years of hard service.



Only Helicoid Pressure Gages Have the Helicoid Movement

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ACCO

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AMERICAN CHAIN & CABLE

929-H Connecticut Avenue • Bridgeport 2, Connecticut

Pressure • Vacuum • Compound

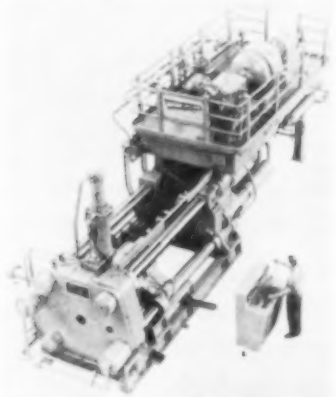
BRIEFS continued

dustry as well as a member of the Fund to evaluate and control research projects. This will allow discussion of the need for a project. If a decision is reached to proceed with one, the committee stays in touch with it, can suggest changes and advice to the project leader. Continued contacts insure that the project will continue toward its predetermined goal.

Companies or individuals interested in a particular subject are encouraged to contact the steering committee to determine areas of investigation. At the present time the ASTE Research Fund is sponsoring six individual partnerships with industry through active steering committees. ▼▼▼

New Aluminum Extrusion Press

A 1700-ton, long stroke oil hydraulic press for billets up to 27 inches in length, has been added to the standard line of presses made by The Watson-Stillman Company, Division of H. K. Porter Company, Inc. All motions of the press are hydraulically operated.



The pumping system is located directly over the main hydraulic cylinder. Arranged for automatic and single cycle pushbutton control, from a pulpit type control station, the press can also be operated manually through a selector switch which is incorporated in the automatic single cycle control.

Operating speeds are advanced 600 ipm; extrusion 35.5 ipm; and

Continued on page 36

DELIVERY OFF THE SHELF

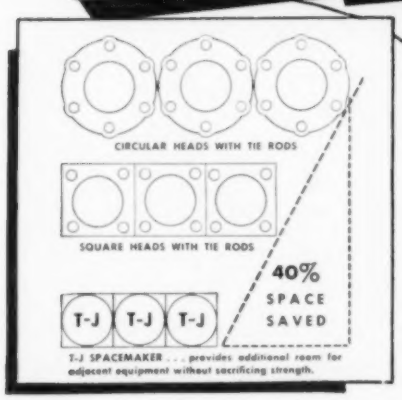
IN **64,000** COMBINATIONS

T-J Spacemaker CYLINDERS

OUTMODE ALL OTHERS . . . SAVE 40% SPACE!

You'll never go back to tie-rod cylinders, once you apply T-J Spacemakers to your push-pull-lift jobs! Advantages in space saved, weight saved, greater strength and off-the-shelf delivery are among the dozens of Extras you get as Standard!

Now — these sensationally popular T-J Spacemaker Cylinders are available off the shelf *in sizes up to 8″*. This means as many as 64,000 different combinations of styles, bores, strokes, mountings, etc. *immediately available!* Oil pressure to 750—Air to 200 P.S.I. Super Cushion Flexible Seals for Air . . . New Self-Aligning Master Oil Cushion. Hard chrome plated bodies and piston rods (Standard). Only from T-J can you get these new ingenious cushion designs! Send for bulletin SM-155-2. The Tomkins-Johnson Co., Jackson, Mich.



See us in
Fluid Power Area
ASTE Show
Booth 225

Member of the
National Fluid Power Association

T-J TOMKINS-JOHNSON
RIVITORS...AIR AND HYDRAULIC CYLINDERS...CUTTERS...CLINCHORS

Circle 146 on Reader Service Card

STAYNEW

HYDRAULIC FILTERS

Save **unnecessary wear on costly pumps and other equipment by preventing intake of abrasive particles.**

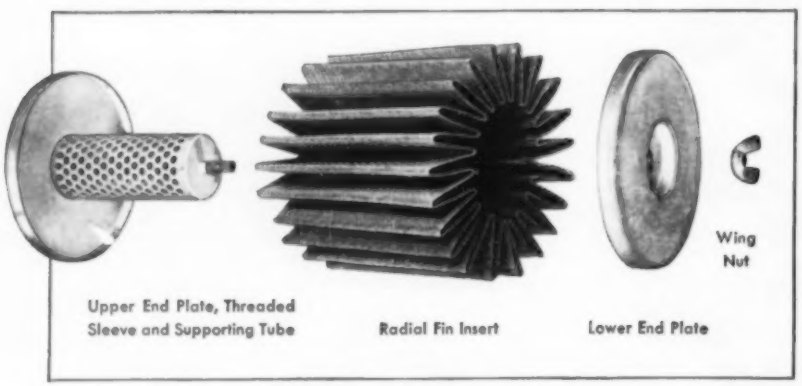
Save **spoilage and rejects at point of use by insuring clean, clear liquid.**

Save **man-hours wasted while new machines are being installed and old ones repaired.**

The Staynew HE Hydraulic Filter is a compact, simplified, efficient unit for use wherever dirty liquids are collected, filtered and re-circulated. Its unique Radial Fin design permits the largest possible filtering area in the smallest possible space—back pressure is reduced to a minimum, and long operation is assured without cleaning or replacement.

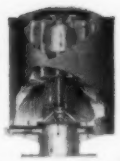
MODEL HE HYDRAULIC FILTER

For top performance and economical operation specify Staynew Filters as original equipment on your hydraulically operated machinery.



Entire unit may be disassembled in 30 seconds merely by unscrewing wing nut at bottom and drawing out Radial Fin Insert.

Insert may be cleaned with solvent or brush in a matter of seconds

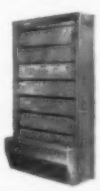


INTAKE FILTERS

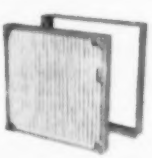
LIQUID FILTERS

PIPE LINE FILTERS

ELECTRO-STAYNEW PRECIPITATOR



AUTOMATIC AIR FILTERS



PANEL FILTERS

SPECIAL FILTERS

DOLLINGER PROTECTOMOTOR STAYNEW FILTERS

DOLLINGER CORPORATION

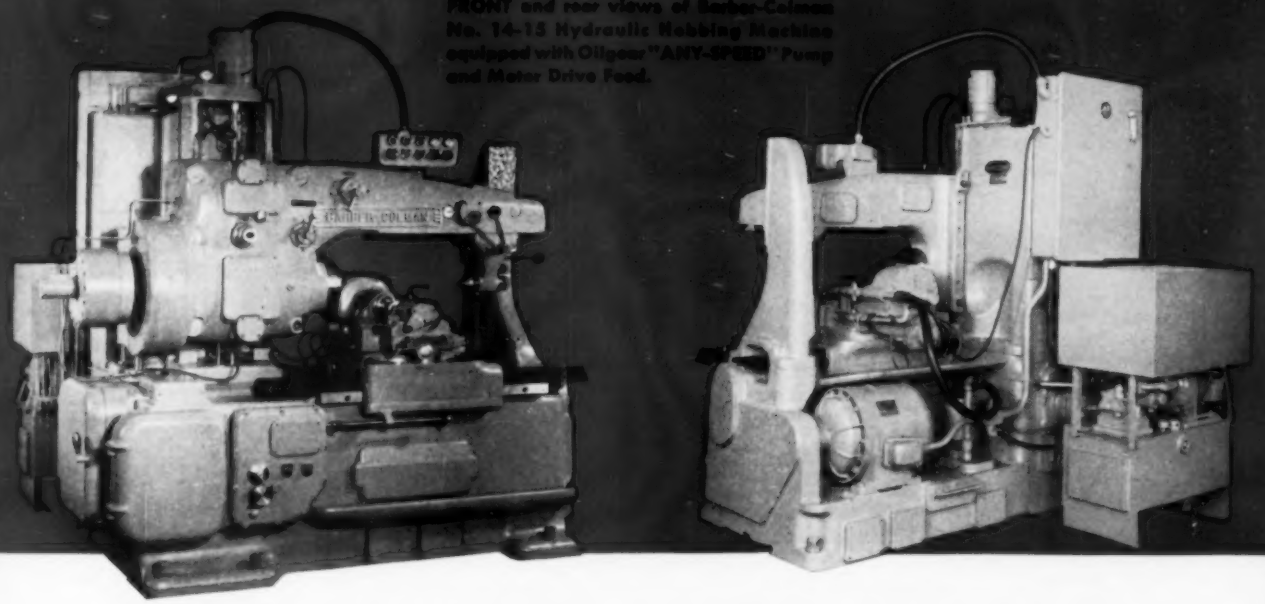
ALL TYPES OF FILTERS FOR EVERY INDUSTRIAL NEED

Write **for Bulletin 330 which contains complete engineering data and illustrated material on Staynew Hydraulic Filters.**
Consult Dollinger engineers on any filtration problem—no obligation.
DOLLINGER CORPORATION, Dept. 65, Centre Park, Rochester 3, N. Y.

LIQUID FILTERS • PIPE LINE FILTERS • INTAKE FILTERS • HYDRAULIC FILTERS
ELECTROSTATIC FILTERS • DRY PANEL FILTERS • SPECIAL DESIGN FILTERS
VISCOUS PANEL FILTERS • LOW PRESSURE FILTERS • HIGH PRESSURE FILTERS
AUTOMATIC VENTILATION FILTERS • NATURAL GAS FILTERS • SILENCER FILTERS

Circle 40 on Reader Service Card

Circle 106

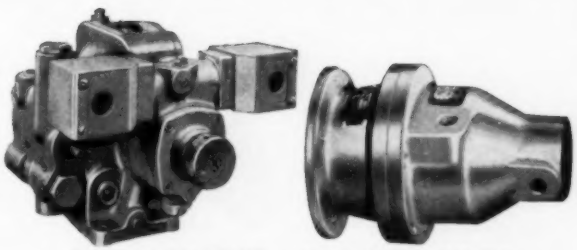


FRONT and rear views of Barber-Colman No. 14-15 Hydraulic Hobbing Machine equipped with Oilgear "ANY-SPEED" Pump and Motor Drive Feed.

ANOTHER TRIUMPH IN MACHINE DESIGN THAT USES OILGEAR "ANY-SPEED" DRIVE FEEDS

Barber-Colman's new high-speed hobbing machine may be totally different from the machines you build. But the machine design problems they encountered in developing this machine could very well be your problems. Among the problems encountered was that of feed. To solve this problem, Barber-Colman selected Oilgear Fluid Power Feeds. These feeds give them the infinitely variable output to provide a hobbing feed range of .020" to 1" per minute. In addition, they provide a far more constant hobbing feed despite changes in load or system temperatures. They also provide cushioned, positive, precise, fast-acting electro-hydraulic control of feed, rapid traverse, and stop through automatic switches. Finally, they provide power for operating ten auxiliary cylinders and three valves. One Oilgear type AX-311 Pump supplies fluid power for the entire machine.

You have much to gain if you stop a moment and ask: "Why are leading machine and machine tool builders turning to Oilgear? Am *I* missing an opportunity to improve machine performance?" Why don't you compare your machine needs with what Oilgear "ANY-SPEED" Drives and Feeds can provide? You can rest assured that we will recommend our product only when it is to your advantage. Tell us your needs. We'll give you a specific appraisal of the possibilities. Write now. THE OILGEAR COMPANY, 1564 W. Pierce Street, Milwaukee 4, Wisconsin.



Type AX-311 PUMP and Type H-311 MOTOR
OILGEAR "ANY-SPEED" DRIVE FEED

OILGEAR
Fluid Power

PIONEERS . . . NOW THREE PLANTS FOR FLUID POWER

PUMPS, MOTORS, TRANSMISSIONS, CYLINDERS & VALVES

HERE'S a helping hand

MARSH BEST SINCE 1900 LEATHER PACKINGS

for your packing problems

Let our packing design specialists help you determine the right packing for each specific job. Your special needs are followed to the letter . . . and MARSH packings are built the way you need them . . . to give dependable service for a long long time.

MARSH THERMO LEATHER PACKINGS

IMPREGNATED WITH SYNTHETICS

ARE DESIGNED "RIGHT" FOR THE NEED

Quality and Dependability
Backed by ***55 Years*** *of Leadership*

CUP PACKING
A piston packing for use on cylinders and controls, low or high pressures.

U PACKING
A single-lip rod or piston packing against low to moderate high pressures.

NON-EXTRUSION OR BACK-UP WASHERS
For use with "O" rings—eliminates extruding and keeps grit and dirt away from "O" rings.

V PACKING
A multi-lip rod packing against medium or high pressures.

FLANGE PACKING
A single-lip packing against low to moderate high pressures.

CUP AND HEEL WASHER
For use against higher pressures—eliminate pinching due to too much clearance.

Engineering and Consulting Service
Ask MARSH field engineers to survey your packing needs and make recommendations.

C·W·MARSH COMPANY

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101 Park Avenue, New York 17, N. Y.
1900 Euclid Avenue, Cleveland 15, Ohio

BRIEFS continued

return 300 ipm. Complete with runout table the press is approx. 120 feet long, 13 feet high and 12 feet wide. Pump is a multiple piston type with servo motor control for control follow-up and speed adjustment. A 900 rpm electric motor drives the pumping unit. ▼▼▼

How Fluid Power Serves Industry And You . . .

. . . is the title of an excellent booklet which may soon come across your desk. Prepared by the Education Committee of the National Fluid Power Association, this beautifully illustrated brochure explains in simple language the part fluid power plays in our mechanical progress. It shows the role it plays in our factories and farms, in our arteries of transportation, in our homes and automobiles, in our national defense.

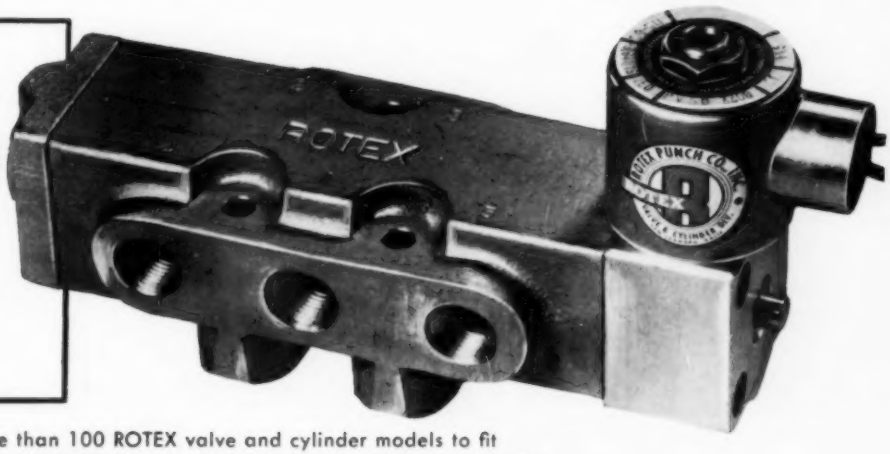
Written for the general public, the text gives an introduction to the industry; tells how fluid power works; why applications of fluid power are expanding. A panorama of fluid power at work is presented.

Members of the National Fluid Power Association—the manufacturers of components used in fluid power systems—will by the wide distribution of this booklet help enlighten the public about the art of . . . Fluid Power. ▼▼▼

Continued on page 38

DEPEND ON THIS LABEL FOR LONGER VALVE and CYLINDER LIFE

CHOOSE FROM OVER 100 MODELS



Yes . . . more than 100 ROTEX valve and cylinder models to fit most needs. ROTEX valves are built to last with the finest in tooling, precision finish and quality metals from body to end caps.

ROTEX CONTROL VALVES are spool type three and four way directional, in ¼", ⅜" and ½" NPT sizes, operated by various manual, mechanical and automatic operators. They are built with dual exhaust ports and with common exhaust port in the four way type . . . single exhaust port in the three way type.

Any one valve consists of one basic valve portion and two operators. These operators may be assembled to either end of the valve portion to fit installation and operating requirements. The valve bodies are made of accurately machined bronze castings and all other parts are aluminum alloy or steel, cadmium plated. Moving seals are standard type O-rings or commercial grade. These valves may be used for air service up to 200 PSI operating pressure and up to 500 PSI hydraulic service. Their maximum operating temperature is 200 degrees Fahrenheit.

ATTENTION DEALERS!

A LIMITED NUMBER OF DESIRABLE TERRITORIES OPEN . . . WRITE FOR INFORMATION

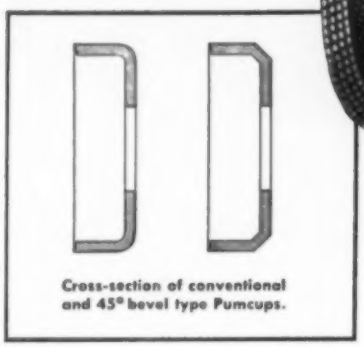
ROTEX

Manufactured by

ROTEX PUNCH CO. Inc.
VALVE AND CYLINDER DIV.
2350 ALVARADO STREET
SAN LEANDRO, CALIFORNIA

Specify **ROTEX** *and be Sure!*

2-way gain with PUMCUPS



Cross-section of conventional and 45° bevel type Pumcups.

Darcova Pumcups are available in various types and textures, in a complete range of sizes, to provide unequalled efficiency and long life in reciprocating pumps, air or hydraulic mechanisms.

★ prolonged high efficiency
★ less maintenance

TODAY hundreds of companies using hydraulic controls, air cylinders or reciprocating pumps are *standardizing* on Darcova Pumcups for piston packing, because they eliminate fluid slippage, costly down-time and maintenance.

Darcova Pumcups make the *most* of the cup packing principle. And, they are made in a complete range of sizes, types and texture-engineered compositions for various pressure-temperature-fluid conditions. Pumcups hold peak efficiency for the life of the cups and outlast other packing as much as 3 to 1.

Why not check these claims right in your own plant? Meanwhile get *all* the facts. Just send for Pumcup Bulletin No. 5503.

DARLING VALVE & MANUFACTURING CO.
Williamsport 15, Pa.

DARCOVA — THE ORIGINAL COMPOSITION CUP

TRADE MARK PUMCUPS

BRIEFS / continued

Hydraulically Operated End-Gate Speeds Material Handling

Designed for trucks and trailers, this gate has a lifting capacity of 2,000 pounds. For smoother operation and less maintenance Gar Wood Industries, Inc. uses only one double-acting cylinder which powers all operations—lifting, lowering, closing and opening. All

these are controlled by one hydraulic valve. At release of control lever—for faster operation a control lever can be provided at each side of the truck—the platform stops and holds at any desired height. The valve also protects against raising and lowering when gate is overloaded. ▼▼▼

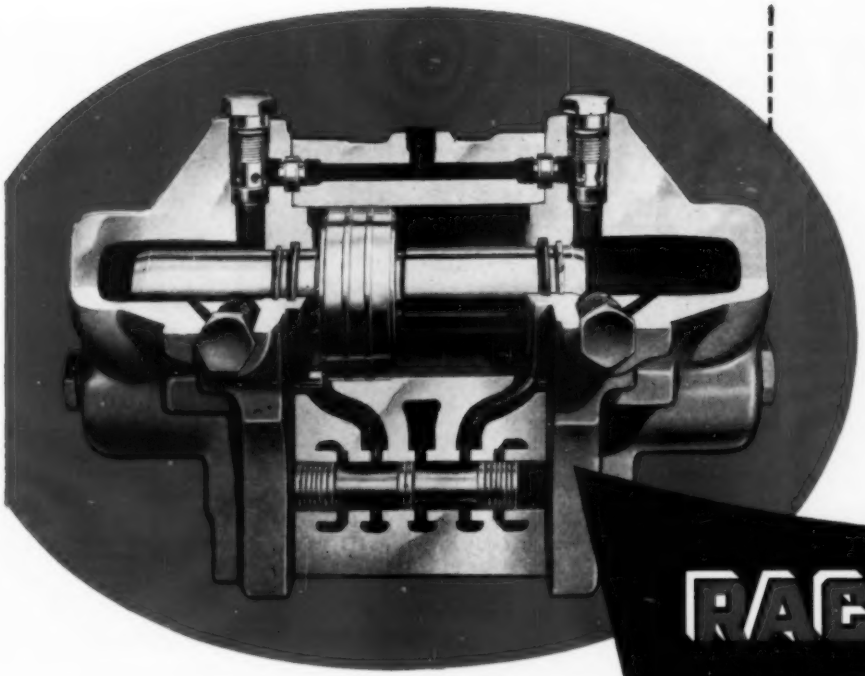
Packing Material Approved by Air Force

Compound 7402-70, manufactured by Linear, Inc., has been approved by the Air Force for conformance to MIL-P-18017A. This specification established the requirements for packings used in aircraft hydraulic systems with MIL-O-5606 fluid at temperatures from —65 degrees F to +275 degrees F. ▼▼▼

Hydraulic Servo Controls Model Position

A servo controlled hydraulic cylinder accurately positions a test model in a preselected program of angles. By providing up to 40 attack angle changes during a 20 second run as compared to

Continued on page 40



RACINE®

HYDRAULIC PRESSURE BOOSTERS

HIGH PRESSURE VALUES— AT LOW PRESSURE COSTS

This patented RACINE PRESSURE BOOSTER builds pressures as high as 5000 psi. With it you can economically multiply the pressure from your low pressure pump as much as seven to one

It allows you to use low pressure at low cost for many operating and closing actions. High pressures to 5000 psi, automatically cut in for final forming and holding operations, or curing cycles on your machine.

Simple design, pressure lubricated, rugged parts and the use of extremely high tensile materials make RACINE Pressure Boosters practically indestructible They last for *years and years* with little maintenance or repair.

If you need pressures to 5000 psi, write us now. Learn how you can have "High Pressure Values at Low Pressure Costs."

OTHER RACINE HYDRAULIC PRODUCTS

MODEL Q
Variable Volume
Vane Type
Hydraulic Pump

4-WAY VALVE
Twin Solenoid
Pilot Operated

FLUID MOTOR
Vane Type
50 to 3500 rpm
Pressures to 1500 psi

RESERVOIR
With Control Panel
Designed to your space
and circuit requirements

NFPA NATIONAL FLUID POWER ASSOCIATION

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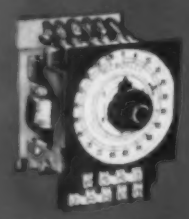
RACINE HYDRAULICS & MACHINERY, INC.
2074 Albert Street
RACINE, WISCONSIN, U. S. A.

EAGLE
Timers and Counters
VITAL COMPONENTS IN MODERN AUTOMATION



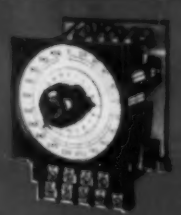
MICROFLEX RESET TIMER
Micrometer dial for precision adjustments. 150+ operating arrangements.

CYCL-FLEX RESET TIMER
With sealed dial, holding contacts, progress pointer for panel mounting.

MULTIFLEX RESET TIMER
For sequence operation of several circuits—each adjustable.

FLEXOPULSE REPEAT CYCLE TIMER
ON-OFF time independently adjustable on calibrated scale.

MULTIPULSE REPEAT CYCLE TIMER
Provides sequential or programmed operation of 2 to 12 circuits.



MICROFLEX RESET COUNTER
Trips switches open or closed after preset number of counts. Electric reset.

Represented above are but a few of the complete line of popular EAGLE Industrial Timers and Counters.

Models are available in a wide range of modifications to fit your particular application. Modern compact design and precise construction of these EAGLE components has won them an enviable coast-to-coast reputation for accuracy and long service-free life of operation. Write us about your needs.

EAGLE SIGNAL CORPORATION
Industrial Division
MOLINE, ILLINOIS
Eagle Timers save time . . . save money

MAIL COUPON TODAY!

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Industrial Division, Dept. AH-356
MOLINE, ILLINOIS

Please send free Automation Booklet "See What Timing Can Do For You."

NAME AND TITLE _____

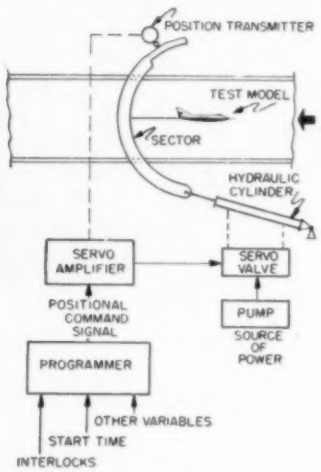
COMPANY _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____

BRIEFS continued

the previous one measurement per run, more efficient utilization of wind tunnel facilities is accomplished. In actual operation the speed of the positioning control system is reduced to keep pace with the data recording equipment. The positioning of the program can be precisely controlled



to permit preselection of angle of attack data points.

The servo valve used in this system is available in capacities for stroking large hydraulic cylinders at speeds of less than one second full stroke. An operating force up to 100 pounds shears foreign particles which may tend to impair valve spool operation.

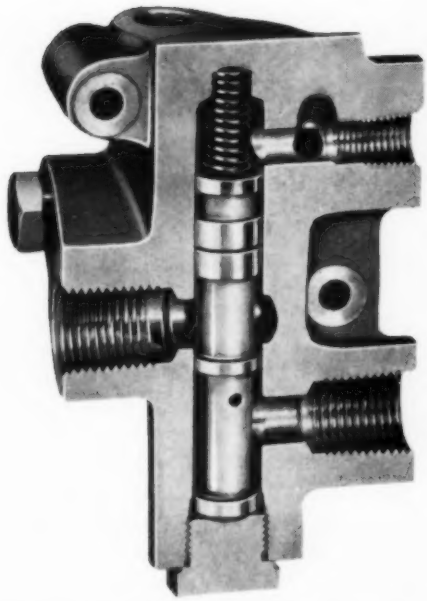
The schematic diagram shows components and arrangements used in sector positioning control system developed by CDC Control Services, Inc. ▼▼▼

Having Trouble Getting Your Patents Issued

. . . Here's why!

According to the New York Patent Law Association the size of the patent examining staff has not kept pace with the increased number of patent applications filed. Congress has appropriated additional funds for new patent

Continued on page 44



NEW Webster Flow Divider

THE MOST ECONOMICAL ANSWER FOR POWER STEERING

and other dual applications

WEBSTER'S NEW FLOW DIVIDER is a specially developed flow control valve specifically designed to provide the utmost economy in power steering and other applications where two separate hydraulic power circuits are to be served. It has been used with great success on agricultural equipment, road-building machinery, materials-handling equipment, and for many other purposes. Its advantages include:

Greatest Economy • Use of the Flow Divider eliminates any necessity for a second hydraulic pump and driving medium—cuts equipment and installation costs substantially.

Less Hydraulic Piping • Use of the Flow Divider simplifies and reduces the amount of hydraulic piping required, since it eliminates the inlet piping which would be required for a separate pump, and it can be installed close to the secondary demand.

Flexibility • The Flow Divider can be installed remotely from the pump, thus providing greater flexibility in the design of hydraulic circuits.

Compactness • The small size (2"x 3"x 5½") of the Flow Divider eliminates installation problems.

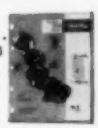
In most applications the Flow Divider is adjusted to provide constant flow to the secondary system. For example, in power steering applications 2½ gpm are constantly diverted to the steering circuit. However, Flow Dividers can also be adjusted to allot pump capacity proportionately between primary and secondary circuits.

The Flow Divider has a capacity of up to 20 gpm at 2000 psi. A built-in damping device prevents noise, eliminates "hunting" effect. It can be provided with a built-in relief valve, if desired.

TANDEM PUMP COMBINATIONS

For those dual applications where you want two pumping units, Webster's Tandem Pump Combinations provide an economical, completely dependable answer. Rated at 1000 psi and 1750 rpm, these combinations are provided with a capacity range for the larger pump from 4.8 to 29.0 gpm. The small pump has a capacity range from 1.0 to 4.0 gpm.

Write today for complete information



AH-3

- ☐ Please send us complete information on Webster Flow Divider
- ☐ Please send us complete information on Tandem Pump Combinations
- ☐ Please send catalog on complete Webster line

Name_____

Title_____

Company_____

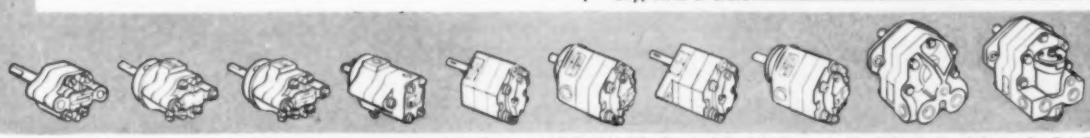
Street_____

City, Zone & State_____

OIL HYDRAULICS DIVISION

WEBSTER ELECTRIC

RACINE • WISCONSIN



MANUFACTURERS OF A COMPLETE LINE OF OIL HYDRAULIC PUMPS FROM 1/5 TO 30 GPM CAPACITY

SAVE MONEY WHILE SPENDING IT!

Specify

HYDRO-LINE

AIR & HYDRAULIC CYLINDERS

SAVE SPACE...

SPEED PRODUCTION...

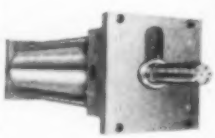
SAVE DOWNTIME...

Compact design of HYDRO-LINE Cylinders with *exclusive* quick-change rod cartridge permits immediate replacement of rod seal, double lip rod wiper and rod bushing without removing or dismantling the main cylinder assembly. Other of HYDRO-LINE'S exclusive combination of features includes: all-steel end caps, one-piece piston retained by prevailing torque-type lock-nut, hard chrome plated piston rods, wrench-flats, heavy cushion adjusting needle valve interchangeable with ball check valve. Meet all JIC Standards.

WHEN YOU DESIGN . . . REMEMBER HYDRO-LINE!

SERIES R—Air or Low Pressure Hydraulic Heavy Duty Cylinder

TYPICAL APPLICATIONS



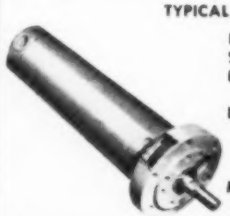
Clamping Fixtures
Loading & Unloading Devices
Counter Balance
Welding Machines
Air Clutches

•

Bulletin Available at Later Date

SERIES J—High Pressure Hydraulic Extra Heavy Duty Cylinder

TYPICAL APPLICATIONS



Feed Cylinders
Slide Cylinders
Die Casting Shot Cylinders
Drilling & Tapping Machines

•

Request Bulletin 53

SERIES S—Air or Low Pressure Hydraulic Extra Heavy Duty Automation Cylinder

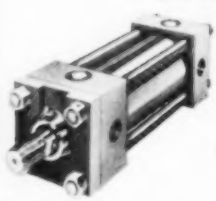
TYPICAL APPLICATIONS

Clamping Fixtures
Welding Machines
Automation Equipment
Loading & Unloading Devices

Request Bulletin 55

SERIES N—High Pressure Hydraulic Heavy Duty Cylinder

TYPICAL APPLICATIONS



Feed Cylinders
Welding Machines
Die Casting Machines
General Machine Tools

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Request Bulletin 56

• Hydraulic and Air Cylinders • Dispensing Cylinders • Single Acting Cylinders • Adjustable Stroke Cylinders • Intensifiers

Representatives in all Principal Cities. Write for the name of the Hydro-Line Rep in your locality.

YOUR SAVINGS BEGIN HERE!

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Hydro-Line CYLINDERS

Remember HYDRO-LINE when you design

HYDRO-LINE MANUFACTURING CO.

5605 PIKE ROAD • ROCKFORD, ILLINOIS

The ENGINEER'S Corner

In these days of automatic highspeed production, careful selection of each machinery component is of vital importance. This is particularly true in the choice of hydraulic or air cylinders. Failure of a cylinder to function at peak capacity not only means "downtime" of the machine itself but in most cases of an entire line. The quality of the product, the pressure rating and the ease of installation and simplification of maintenance are all factors to be considered in purchasing cylinders. Many cylinder manufacturers provide both square and round type cylinders in a wide variation of bore sizes for varying pressure ranges. Careful investigation of cylinder sources almost always results in a standard cylinder to meet the exact design requirements of the machinery involved.

Important checkpoints in selection of a cylinder include: a precision cylinder barrel bore . . . the *end caps* and *mountings* should be of solid steel to prevent breakage . . . the *ports* should be of adequate size and unobstructed for unrestricted flow . . . *cushion adjustment* and *ball retainer* should be accessible for easy maintenance. Interchangeability of cushion adjustment and cushion ball check is a desirable feature to look for . . . Cushion for most applications should be approximately 1" long with all mating parts machined to extremely close tolerances and provide for perfect alignment.

Pistons depending upon the application may consist of piston rings or a type of flared lip seal . . . *piston rods* for long life and resistance to scoring should be heat treated, stress relieved, ground, polished and hard chrome plated. . .

A recent development in cylinder design is a *removable cartridge gland* which permits removal of the entire *cartridge* without dismantling of the cylinder. This is a particularly desirable feature to look for . . . *rod ends* should be turned down past wrench flats to facilitate removal and replacement of cartridges without damaging lip of the seal.

As Chief Engineer for a leading manufacturer of air and hydraulic cylinders, a great deal of my own time is spent in research and development work. Although we have always maintained highest quality control standards within our plant we know that building the best today, may not mean we will be ahead of the field tomorrow. Thus, we constantly strive to add new features to make our product better to uphold the reputations of the customers we serve . . . who in turn must also keep ahead of obsolescence and competition.

Joseph L. Bosi

Hydro-Line Manufacturing Co.
Chief Engineer

"BIG STOPPER"

World's largest Dynamometer protected by World's Greatest Lubrication Knowledge!

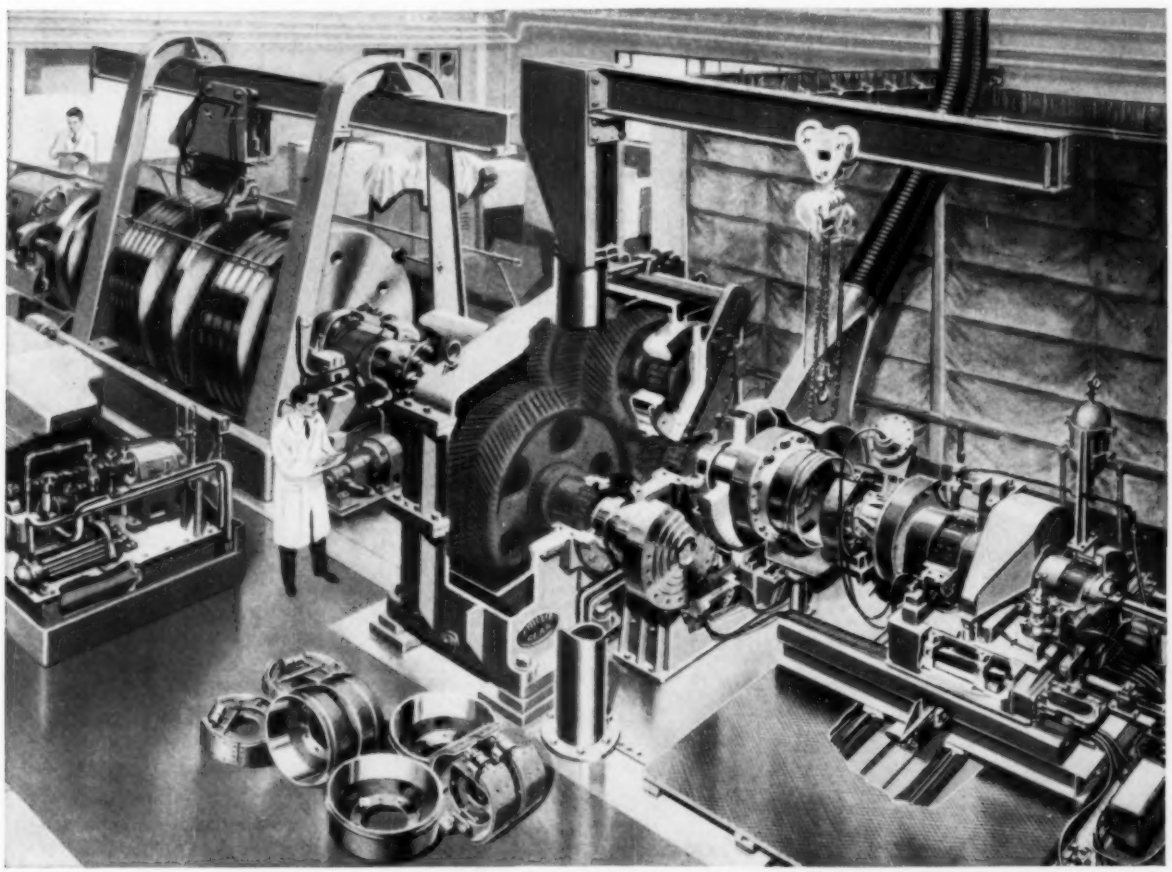
When a giant bomber lands at 200 miles an hour . . . when a speeding train must make a quick stop . . . when a high-balling truck has to cut speed suddenly—life and property hang on just a thin layer of brake lining. To learn how to make brakes safer and more durable is the purpose of the "Big Stopper"—largest dynamometer of its kind in the world.

The "Big Stopper" is 48 ft. long, 10 ft. high, weighs over 200 tons. It was designed and built by Johns-Manville—is now in operation at their research center in Manville, New Jersey. Here's how it works:

One of two motors—500-hp or 350-hp—drives a flywheel unit which can be weighted with up to 27 tons of metal discs (left) to produce varying brake loads. Brakes to be tested are mounted on a stand (right) which can be shifted to either a high speed or low speed shaft. Electronic controls apply the brake and automatically record pressures, speeds, temperatures and other vital data necessary to evaluate the brake material.

This complicated, costly machine is protected 100% by a program of Socony Mobil Correct Lubrication. Famous Mobil lubricants guard gears against extreme pressures and shock loads. Mobil hydraulic oils assure precise, trouble-free operation of the hydraulic system. Other Mobil oils and greases protect motors and all other moving parts.

You can give *your* machines this same unsurpassed lubrication protection. Why not see how it can improve your production—cut your costs?

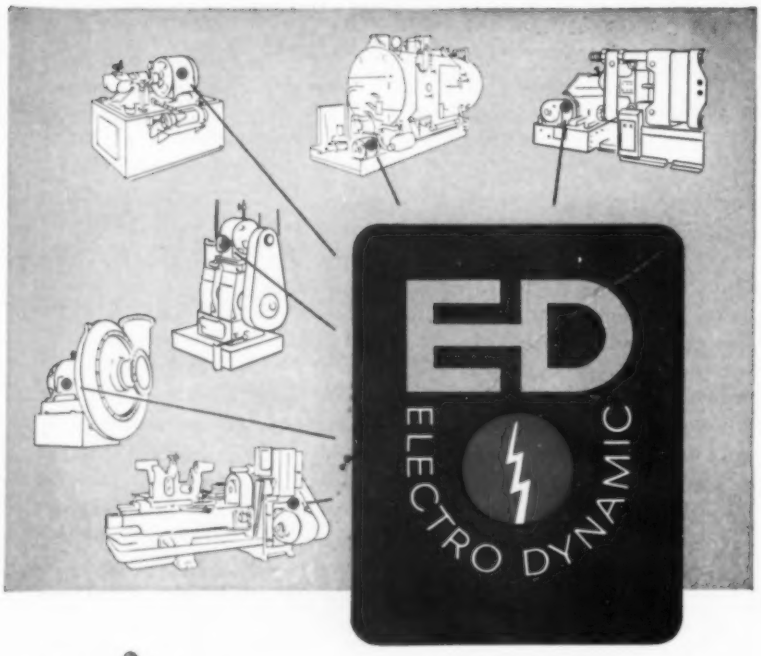


Double helical gear reduction unit built by Philadelphia Gear Works, Inc.

SOCONY MOBIL *Correct Lubrication*

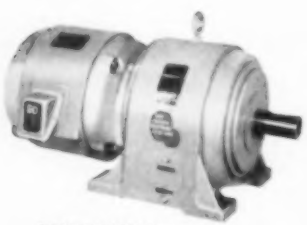
FIRST STEP IN CUTTING COSTS

SOCONY MOBIL OIL CO., INC., and Affiliates: MAGNOLIA PETROLEUM CO., GENERAL PETROLEUM CORP.



STANDARD MOTORS

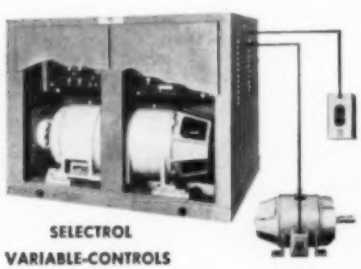
THIS EMBLEM IDENTIFIES EXTRA DEPENDABLE INDUSTRIAL MACHINERY



GEAR-ED-MOTORS

The red *power spot* on industrial machinery means "Powered by Electro Dynamic." Such machinery relies with confidence on the *extra dependability* of Electro Dynamic motors, the proven industrial motors which give industrial equipment *extra dependable* operation.

SELECTRON VARIABLE-CONTROLS



SELECTROL VARIABLE-CONTROLS

NEW...

Write for Brochure 50 and literature on new E.D. motors and drives.

Electro Dynamic division of General Dynamics Corporation Bayonne, New Jersey

GD

ELECTRO *xtra* DYNAMIC *ependable motors*

BRIEFS continued

examiners, but with existing demands for engineers and scientists in industry it has been impossible to obtain enough candidates having the necessary qualifications. The Association points out that the patent examiner holds a key position in the advancement of technology and steps have been taken to increase the examining staff.

Engineers and scientists holding a college degree in engineering or applied science, or a degree with a major in chemistry or physics or with certain combined credits are eligible for appointment as patent examiners, without examination, upon application to the Commissioner of Patents in Washington. ▼▼▼

Recent Publications

1955 Collected Technical Papers. Published by the American Society of Tool Engineers, Detroit. 347 pp. Leatherette bound. Price $5.00.

This volume covers all of the papers and panel discussions presented at the 23rd annual convention of the ASTE in Los Angeles. Subjects discussed by the panels are: Preparing engineers for manufacturing responsibilities; Plastic tooling for production; Coordination of manufacturing management; and Quality control through realistic tolerances. ▼▼▼

Future Events

March 14-16: 1956 Aviation Division Conference of the American Society of Mechanical Engineers. Beverly-Hilton Hotel, Los Angeles, California.

March 18-21: Spring Meeting, American Society of Mechanical Engineers. Multnomah Hotel, Portland, Oregon.

March 19-21: Society of Automotive Engineers. National Production Meeting and Forum. Hotel Statler, Cleveland, Ohio.

March 19-23: 1956 ASTE Industrial Exposition. International

Continued on page 46

The first comprehensive filtration guide ever edited specifically for designers.

Where are filters used? Why are filters used? How do filters save money? Now for the first time Purolator's new "Filtration Manual for Designers" has all the answers gathered together in one place.

Some typical section headings

- **space requirements**
- **filter costs**
- **selection of type of element**
- **deciding flow capacity needed**
- **economics of filtration**
- **how Micronic® and metal edge filters are made**

"Filtration Manual for Designers" spells out application considerations in detail including degree of filtration, flow rate, contamination to be removed, viscosity of fluid, plus a complete glossary of terms that apply to filtration. Printing of this manual is limited so please send in coupon for your copy today.

PUROLATOR PRODUCTS, INC.
Dept. D8-326, Rahway, N. J.

Please send my copy of your "Filtration Manual for Designers." I'm enclosing 25¢ for postage and handling.

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BRIEFS / continued

Amphitheatre, Chicago, Illinois. "Tooling for Tomorrow" will be the theme of the exposition, which will be held in conjunction with the Society's 24th annual convention.

April 10-12: 12th Annual Meeting of the Metal Powder Association and the 1956 Metal Powder Show. Hotel Cleveland, Cleveland, Ohio.

April 30-May 4: SAE Aircraft Committee Meetings, Conrad Hilton Hotel, Chicago, Illinois.—April 30-Committee A-3, Aircraft Fittings and Flexible Hose Assemblies; May 1—Subcommittee A-6C, Hydraulic Pumps, Motors & Air Compressors; May 2, 3 & 4—Committee A-6, Aircraft Hydraulic and Pneumatic Equipment.

May 9-11: Fourth Welding Show, sponsored by the American Welding Society. Memorial Auditorium, Buffalo, New York. Welding Committee of Atomic Energy Commission will co-sponsor some of the 21 technical sessions.

May 14-17: First Design Engineering Show. Convention Hall, Philadelphia, Pa. Machine Design Division of ASME will sponsor design engineering conference to coincide with exposition.

May 27-31: 1956 Spring Meeting, National Fluid Power Association. The Greenbrier, White Sulphur Springs, West Virginia.

June 5-8: The Material Handling Institute's Exposition of 1956. Public Auditorium, Cleveland, Ohio.

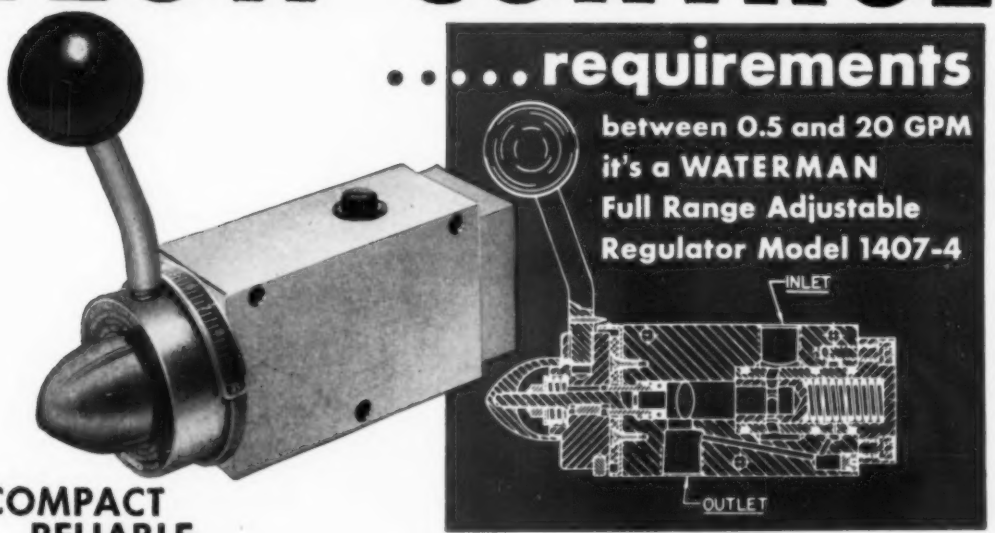
September 17-21: The Instrument Society of America, the 11th Annual Instrument-Automation Conference and Exhibit. New York Coliseum, New York.

October 18-19: 12th National Conference on Industrial Hydraulics. Sherman Hotel, Chicago, Illinois. Conference Secretary is Raymond D. Meade.

October 30-November 1: 1956 Fall Meeting, National Fluid Power Association. Hotel Cleveland, Cleveland, Ohio. ▼▼▼

FOR YOUR
FLOW CONTROL
....requirements

between 0.5 and 20 GPM
it's a WATERMAN
Full Range Adjustable
Regulator Model 1407-4



COMPACT
RELIABLE
RUGGED

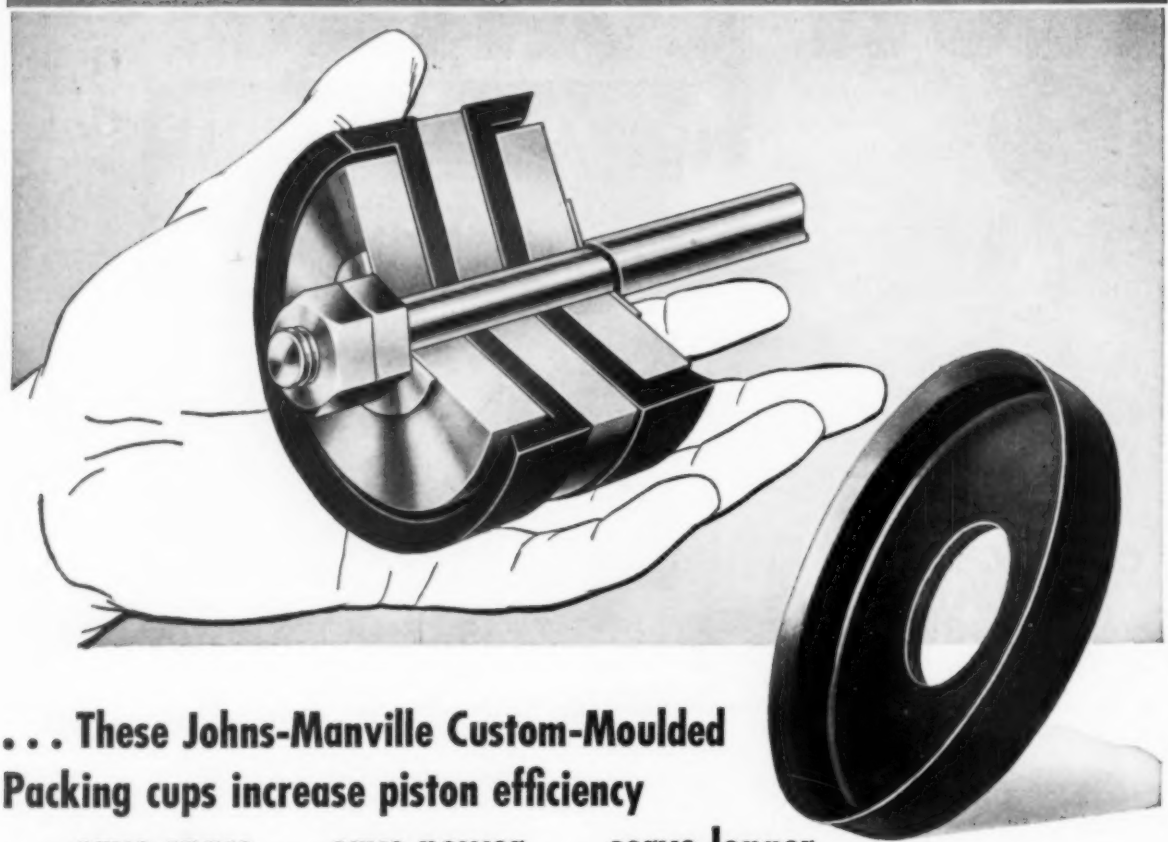
- Minimum to maximum flow adjustment obtained by 180° handle rotation.
- Flow rate changes easily accomplished under any conditions of pressure or back pressure.
- Adjustable handle tension eliminates need for wrenches and locking levers for changes in flow setting.
- Ideally suited for installations requiring frequent changes in operating speeds or throttling control during the machine cycle.
- Choice of control—either right or left rotation of control handle.
- Multiple control—with right and left hand rotation operator can control two operations simultaneously.
- Aluminum bodies housing steel working parts provide light weight units for easy handling and installation.

LOOK TO WATERMAN FOR THE ANSWER TO YOUR FLOW CONTROL REQUIREMENTS

Write for latest illustrated bulletin A

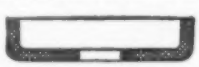
WATERMAN
ENGINEERING COMPANY
725 CUSTER AVENUE • EVANSTON, ILLINOIS

Looking for a more efficient piston design?



. . . These Johns-Manville Custom-Moulded Packing cups increase piston efficiency . . . save space . . . save power . . . serve longer

TYPE A . . . The Type "A" J-M Moulded Packing Cup is the "standard" for use on the pistons of pumps and on various hydraulic and pneumatic mechanisms. The lip forms a tight seal under discharge pressure, but relaxes on the reverse stroke, reducing friction and conserving power.



TYPE B . . . This type of cup is essentially the same as Type A, except that the leading edge of the lip is square instead of beveled. This construction provides greater strength where the lip may be exposed to distortion or excessive wear due to openings in cylinder walls.

Johns-Manville Moulded Packing Cups can help you improve piston designs. They provide a highly efficient seal . . . improve equipment performance . . . lower operating and maintenance costs. These custom-made packings are extensively used on all types of slow moving pistons and rams operating under high or low pressures and temperatures.

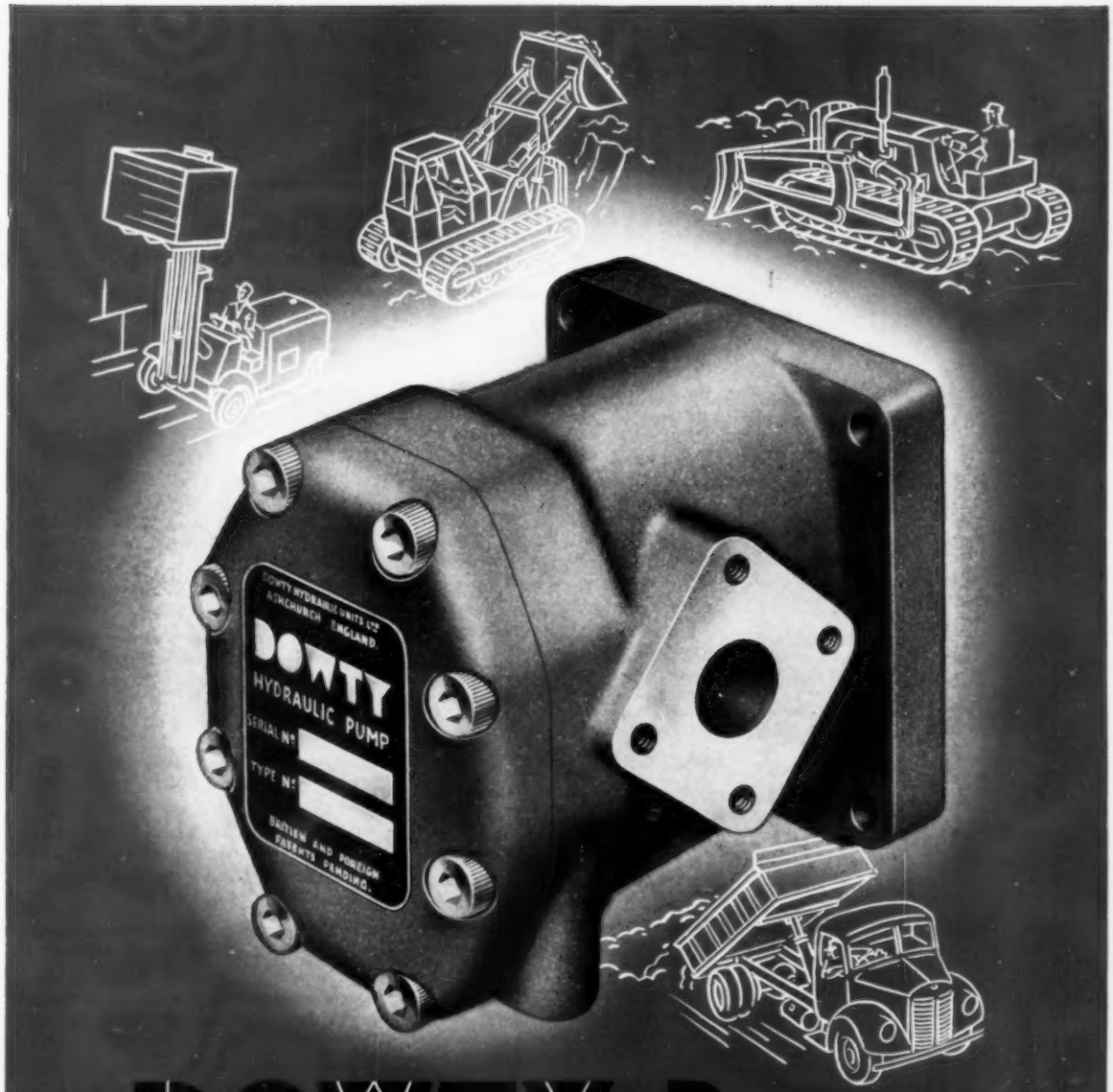
Johns-Manville Moulded Packing Cups may be used on practically all air or hydraulic-operated cylinders. For instance, those which are in such equipment as reciprocating pumps, hydraulic jacks and presses, pneumatic chucks, governors, lift trucks, grease guns, valves, drilling and boring machinery . . . or on any other equipment where efficient piston design is essential.

You have your choice of a number of styles and compositions of these precision-moulded cups to meet temperatures and pressures encountered in hydraulically operated equipment. Types "A" and "B," shown here, are most widely used on inside-packed pistons with the outside edge or lip contacting the cylinder wall or liner. Other types are available, however, for other services.

If you would like more information on these or other types of Johns-Manville Custom-Made Piston Packings, get in touch with your Johns-Manville Packings Distributor, or write Johns-Manville, Box 60, New York 16, N. Y.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville PACKINGS & GASKETS



DOWTY Pumps

mean better hydraulics

OUTPUTS: 1 TO 50 G.P.M. • LOW COST
HIGH PERFORMANCE • PROMPT DELIVERY
SIMPLE CONSTRUCTION

- Pumps
- Control Valves
- Couplings
- Rams

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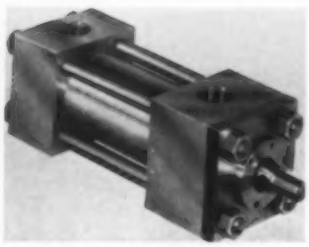
New Products

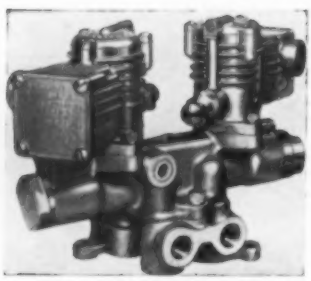
Components, tools and equipment for fluid power systems. For more information fill in and mail post card bound in this issue.



HEAVY DUTY CYLINDERS . . . for 2000 psi

Construction: JIC cylinder has heavy walled seamless steel tubing, micro-honed for minimum friction; and rolled steel heads recessed to confine the tube, prevent breathing, and provide additional protection against leakage under the most severe usage. Piston rods are hard-chrome plated and turned, ground, and polished. The multiple-lip, self-compensating rod gland packing provides excellent pressure sensitivity and long life. This packing is contained in a removable cartridge which facilitates replacement without disassembling the cylinder. Cylinders are available in bore sizes from 1½ to 8 inches.

Ortman-Miller Machine Co.
Hammond, Indiana
Circle 170 on Reader Service Card



SOLENOID VALVE . . . for 600 cycles per min.

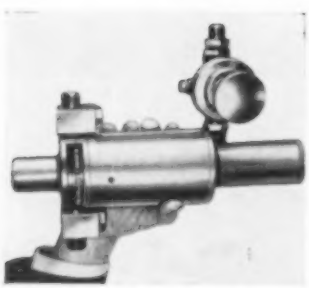
Designation: Double-solenoid Speed King

Construction: Built to JIC Standards double solenoid, pilot operated, 4-way valve is fully enclosed and is moisture and dust proof. Pilot plungers and valve stem are the only moving parts and there are no springs in the main valve. Unit requires only momentary electrical contact. Normal service life is estimated to be in excess of 20 million cycles.

Specifications: Valves are available in ¼, ⅜, ½, ¾, and 1-inch pipe sizes with foot or sub-base mounting. Pressure ranges are 35-200 psi air, and 35-125 psi oil for valve with internal pilot supply; 0-250 psi air and oil valves with external pilot supply; and 50-125 psi water for valves with internal pilot supply.

Features: Stainless steel main valve stem floats on stationary O-rings to minimize wear and friction. Repacking can be accomplished without disturbing piping. Pilots and sub-base mounted valve body can also be replaced without removing piping, thus reducing maintenance downtime.

Valvair Corp.
Akron, Ohio
Circle 171 on Reader Service Card



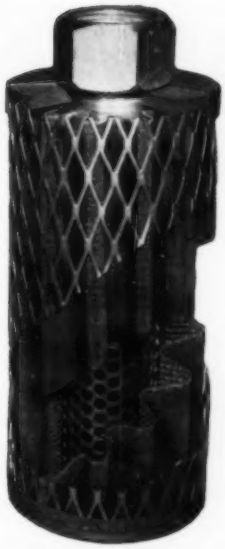
BOOSTER . . . for pressure testing

Designation: Airhydropump

Features: Unit gives pressures up to 10,000 psi from 100-psi air line. Booster has no metal-to-metal moving parts, and can be used with either oil or water. Air-reducing and control valve permits any required hydraulic pressure to be produced but not exceeded. On a closed circuit the pump maintains the pressure for an indefinite period without consuming additional air.

Application: Unit is especially recommended for pressure testing. Low price and compactness make it practical to have an individual booster at each test point giving a wide range of simultaneous pressures.

Davies Brothers
New York, N. Y.
Circle 172 on Reader Service Card
Continued on page 54

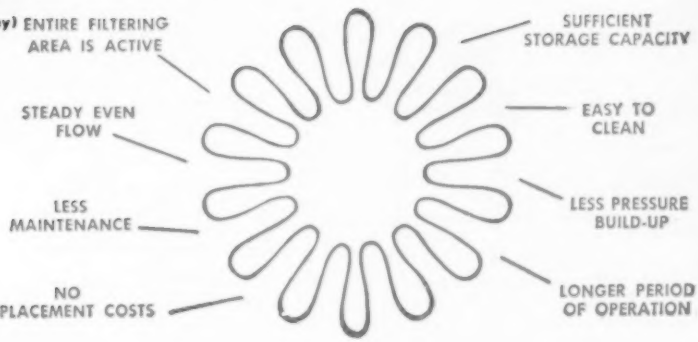


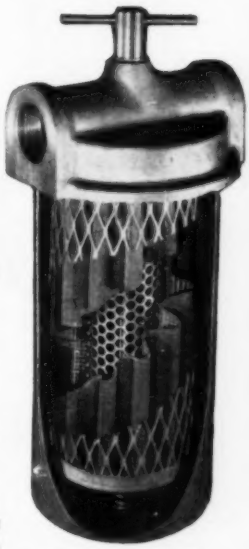
When You Need A Filter— Get The Advantages Of Marvel SYNCLINAL Design

it's BALANCED For Top Performance!

SUMP TYPE (Cutaway)

LOOK FOR THESE IMPORTANT FEATURES





LINE TYPE (Cutaway)

For All Hydraulic and Other Low Pressure Liquid Systems

In the selection of a filter to obtain maximum efficiency and quality, the most important point to consider is a specific type filter that will offer greatest ACTIVE filtering area with ample storage capacity for filtered out particles, rather than total filtering area alone. Over 650 Original Equipment Manufacturers install Marvel Synclinal Filters as Standard Equipment because they are designed to give this all-important balance for greatest efficiency in filtration of liquids in all hydraulic and other low pressure circulating systems. Flow of liquids is mantained at a constant, steady rate of speed produced by the pump which brings about the desired effect of a gentle, evenly distributed accumulation of filtered out particles against the entire filtering surface with less restriction of flow. Result—longer periods of productive operation at minimum maintenance down-time. If this important balance is lacking due to efforts to cram too much filtering mesh for the sake of total rather than active area, filters soon become clogged causing pressure build-up, turbulent flow and in general decreases the efficiency of operating equipment. Depend on Marvel Synclinal Filters For All Your Filtration Requirements.

IMMEDIATE DELIVERY!
As in the past, Marvel continues to offer Immediate Delivery.

EASY MAINTENANCE
Both sump and line types may be disassembled, cleaned and reassembled by any workman in a matter of minutes. Line type operates in any position and may be serviced without disturbing pipe connections.

A SIZE FOR EVERY NEED
Available for sump or line installation in capacities from 5 to 100 G.P.M. Greater capacities may be obtained by multiple installation (as described in catalog). Choice of monel mesh sizes range from coarse 30 to fine 200.

FILTERS FOR FIRE-RESISTANT HYDRAULIC FLUIDS
Marvels most recent development is a filter for the efficient filtration of all types of fire-resistant hydraulic fluids.

WATER FILTERS
Both sump and line type filters have been adapted for use in all water filtering applications. No changes have been made in the basic, balanced synclinal design.

Catalogs containing complete data available on request

ASTE — Visit Our Booth — INDUSTRIAL EXPOSITION — INTERNATIONAL AMPHITHEATRE — CHICAGO ..... MARCH 19-23, 1956

MARVEL ENGINEERING CO.

7227 N. Hamlin Ave., Chicago 45, Ill. **PHONE: Juniper 8-6023**

Without obligation, please send me complete data on Marvel Synclinal Filters, as indicated: AH-3

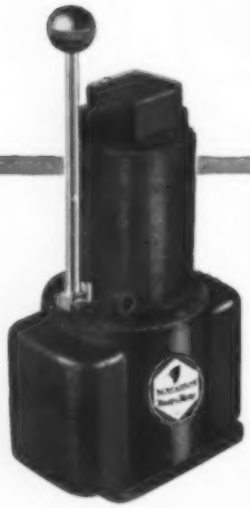
- ☐ Catalog #107—For Hydraulic Oils, Coolants and Lubricants
- ☐ Catalog #301—For WATER
- ☐ Catalog #200—For Fire-Resistant hydraulic fluids.

Name ..... Address .....

Title ..... City .....

Company ..... State .....

CHOOSE BLACKHAWK
for your product



Electric *Power-Packer*

Here's the *dependable* answer for electrically-operated hydraulic control of implements and attachments. Uses a 6-volt standard automotive starter-motor for power.

Speed—Lifts the load three times faster than hand-operated pumps.

Remarkable Efficiency means low battery drain. Tests show ordinary 6-volt auto battery (without rest or charging) still operating after 150 average lifts.

Positive Displacement means no slippage under varying temperature and load conditions.

Control is simple, *precise!* It lifts and lowers at any desired speed — and holds the load, too.

Quiet, Smooth Operation— no peak loads on the battery — thanks to the balanced 4-piston wobble-plate pump.

Simple Installation —It is a complete package — pump, reservoir, valve and electric head. Only four mounting holes. Port is ¼" N.P.T. for use with Blackhawk equipment hose.

SPECIFICATIONS

MODEL	P-247	P-248
Normal Operating Pressure (P.S.I.)	5000	2500
Maximum Intermittent Pressure (P.S.I.)	10,000	5000
Reservoir Capacity (Closed Reservoir)	105 cu. in.	105 cu. in.
Reservoir Capacity (Vented Reservoir)	166 cu. in.	166 cu. in.

For use with 6 volt D. C. Systems.

P-248 delivers 70 cu. in. of oil per minute at 2500 p.s.i. with power drain of 660 watts; or, another example, it delivers 50 cu. in. of oil per minute at 5000 p.s.i. with power drain of 815 watts. Weight 58 lbs. 8 oz.

(Electric pump-head is available as separate unit for converting P-60 and P-63 Power-Packers from *hand-operation* to electrical operation in the field. It's *easy* because reservoirs of hand-operated and electrically-operated units are identical.)

Hand-Operated *Power-Packer*
(Double-Acting)

Specified as "standard" by hundreds of equipment manufacturers. No other hand-operated pump equals its sales records.

SPECIFICATIONS

MODEL	P-60	P-63
Maximum Pressure (P.S.I.)	5000	2500
Displacement per stroke (Cu. In.)	.294	.557
Diameter of Pump Pistons	½"	11/16"
Reservoir Capacity (Cu. In.)	114 cu. in. closed 231 cu. in. vented	114 cu. in. closed 231 cu. in. vented

Weight 30 lbs. Has ¼" N.P.T. Port. Also available without reservoir for integral mounting.

Hand-Operated *Power-Packer, Jr.*
(Single-Acting)

The low cost of this refined, compact pump series permits hydraulics on a broadened range of equipment.

SPECIFICATIONS

MODEL	P-146	P-147	P-148
Maximum Operating Pressure (P.S.I.)	6000	5000	2500
Displacement per Stroke	.15033	.19635	.37122
Diameter of Pump Piston	7/16"	½"	11/16"
Handle Effort at Maximum Pressure	57 lbs.	61 lbs.	58 lbs.
Reservoir Capacity	53 cu. in. when closed		

Weight 14 lbs. 7 oz. Has ⅜" N.P.T. port bushed to ¼" N.P.T.

Power-Driven *Power-Packer*

Pump, valve and reservoir are in *one package* . . . eliminating expensive piping and installation problems. The pump has the same characteristics found in the popular P-104 Pump (opposite page).

SPECIFICATIONS

MODEL	P-219	P-220
Capacity of G.P.M. at 900 rpm	1.375	1.375
Maximum Intermittent Pressure (P.S.I.)	4000	4000
Normal Operating Pressure (P.S.I.)	2500	2500
Recommend Speed Range (rpm)	600-120	600-1200
Reservoir Capacity (closed)	1 gal.	½ gal.
Reservoir Capacity (vented)	2 gal.	1 gal.
Weight	70 lbs.	52½ lbs.
⅜" N.P.T. port.		

See Sweet's Product Design File 6a / BL

YOU ARE INVITED TO WRITE FOR FULL FACTS — mentioning Blackhawk components in which you are specifically interested. Engineering counsel willingly furnished—in confidence. Blackhawk Mfg. Co., Hydraulic Control Division, Dept. H-5236, Milwaukee 1, Wis.

HYDRAULIC CONTROLS

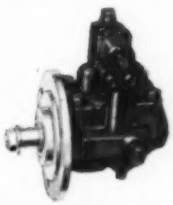
Scores of critical designers and buyers recognize that *Blackhawk* hydraulics create exclusive advantages for the engineering, manufacturing, sale and service of their products. Blackhawk has specialized in this field for over 25 years.

15 H.P. 6-PISTON WOBBLE-PLATE POWER-DRIVEN PUMP

This modern pump — *No. P-237* — offers over-all efficiencies above 90% — with no premium in price. Positive displacement makes a wide range of pressures and speeds practical. Delivers 3 G.P.M. at 1350 R.P.M. and 6000 P.S.I. with only 11.65 H.P. input. Following are characteristics at maximum recommended speed and pressure for intermittent service.

Speed R.P.M.	G.P.M.	Pressure	H.P.
2200	4.7	4800 P.S.I.	15
1750	3.9	6000 P.S.I.	15

Weight — 40 lbs.



5 H.P. TWIN-PISTON POWER-DRIVEN PUMP

The positive-displacement P-104 pump is famous for the amazing performance it achieves with its low-cost design. Practical for pressures up to 4000 P.S.I. in intermittent operation. At 900 R.P.M. it delivers 1.375 G.P.M. at 4000 P.S.I. with 5 H.P. input.

SPECIFICATIONS

Recommended maximum pressures — 4000 P.S.I. for intermittent use . . . 2500 P.S.I. for continuous use.

Capacity (at 900 R.P.M), 1.375 G.P.M.

Recommended Speed Range (R.P.M.) — Maximum 1200—Normal *900 — Minimum 600. *Normal speed may be exceeded at reduced pressures.

The integral safety valve is normally set 500 P.S.I. above working pressure.

Over-all dimensions: 5¾" x 7⅝" x 7¼" (including shaft) — Weight: 18 lbs. 4 oz.

CYLINDERS

Blackhawk offers a long line of standardized hydraulic cylinders. Exclusive, leakproof designs. Special single or double-acting cylinders are produced on quantity orders.

VALVES

"VALVBANK" POSITIVE-SEALING CONTROL SYSTEM

The V-68 valve is an open-center, series-type precision-control valve. Hydraulically balanced, it handles up to 6000 P. S. I. working pressures with finger-tip actuation. Flow capacity up to 6 G.P.M. "Valvbanks" can be built up in any combination of single and double-acting control units and include a relief valve. It is spring-returned to the neutral "hold" position, providing "deadman control." All ports are ½" standard pipe thread.

SELECTOR-TYPE CONTROL VALVE

The V-66 precision control valve is for use up to 4000 P.S.I. and 2.5 G.P.M. Available in "bank" style like the V-28. Compact. Normally recommended for use with the P-104 power-driven pump. Handle remains in selected position until manually returned. Has ⅜" N.P.T. ports.

SINGLE-ACTING POSITIVE CONTROL VALVE

An open-center, spring-returned, single-acting control valve. Simple construction—low cost—rugged. The V-15 includes a cushioned lowering device which also allows connection of valves in series for multiple ram control. For light return loads, the V-16 affords less restriction in returning oil, but can be used in the control of only one ram — handling up to 2.5 G.P.M. maximum flow and 4000 P.S.I. operating pressure. All ports are ⅜" N.P.T. bushed to ¼" N.P.T. for use in system that has small volume. Weight —6 lbs. 12 oz.

AUXILIARY VALVES

Blackhawk Valves are also available for remote release and relief purposes, adjustable throttling, manual shut-off and safety pressure-release.

BLACKHAWK HYDRAULIC EQUIPPED

An Emblem Representing Dependability Throughout Industry

BLACKHAWK

ADEL *Industrial Hydraulic Equipment*

for PEAK PERFORMANCE ADEL Hydraulic Valves and Pumps are setting new and ever higher standards for precision in manufacturing and efficient performance in operation. Following are but a few of the wide variety of models to meet all operating conditions.

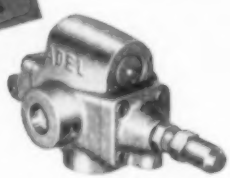
GEAR-TYPE HYDRAULIC PUMPS

For 1000 psi service with rated capacities at 1800 rpm of from 1.5 to 46.8 gpm.

DIRECTIONAL CONTROL VALVES

4-way valves with spring-centered, spring-offset, and 1, 2, or 3 position detent action. 1500 psi. Flows to 28 gpm.

BY-PASS VALVES



Relief, Sequence and Unloading valves. Direct or remote operation, 50 to 1500 psi range.

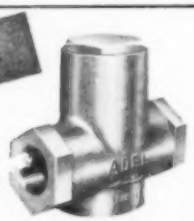
VOLUME (FLOW) CONTROL VALVES

Compensated type maintains constant flow over wide differential pressure range. No drain line required. 1500 psi.

PILOT VALVES

2 or 3 position detent. With or without dog or lever. Can be used as 4-way valve in small circuits. 1000 psi.

CHECK VALVES



Valves allow free flow in one direction only. Many variations available. 3000 psi.

For complete engineering specifications and counsel, Address: ADEL PRECISION PRODUCTS, DIVISION OF GENERAL METALS CORPORATION, 10771 Van Owen Street, Burbank, California.

ADEL PRECISION PRODUCTS
A DIVISION OF GENERAL METALS CORPORATION

Manufacturers of Industrial Hydraulic Valves and Pumps

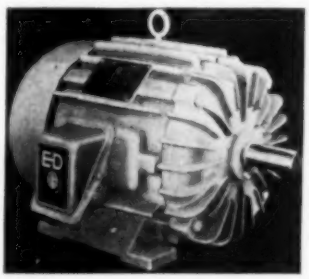
DISTRIBUTORS: AIR-DRAULIC EQUIPMENT CO., HOUSTON, TEX. • AIR & HYDRAULIC ENGINEERING CO., NEW HAVEN, CONN. • RUSS CHAMBERLIN COMPANY, PORTLAND 14, ORE. J. BOYD COATES, GLENSIDE, PA. • CORBY SUPPLY COMPANY, ST. LOUIS, MO. • FRANK T. DONNELLY COMPANY, PITTSBURGH 38, PA. • HASKEL ENGINEERING & SUPPLY CO., GLENDALE 4, CALIF. • HASKEL ENGINEERING & SUPPLY CO., SAN FRANCISCO 7, CALIF. • AIR-DRAULICS COMPANY, PHOENIX, ARIZ. • INDUSTRIAL AIR & HYDRAULIC EQUIP. CO., DETROIT 15, MICH. LINCOLN SUPPLY COMPANY, PROVIDENCE, R. I. • L. H. MONSEES, INDEPENDENCE, MO. • THE NEFF ENGINEERING CO., FORT WAYNE 3, IND. • POWER DRIVES, INCORPORATED, BUFFALO, N. Y. • SCOTT EQUIPMENT & ENGINEERING CO., DAYTON 10, OHIO • ROBERT TAYLOR & SONS, SALT LAKE CITY 10, UTAH • WYATT SALES COMPANY, CLEVELAND 15, OHIO TRI-STATE SUPPLY COMPANY, BROOKLYN 33, N. Y.

New Products / continued

TOTALLY ENCLOSED MOTOR ... new compact design

Designation: Type H

Design: Motors are totally enclosed non-ventilated and totally enclosed fan cooled conforming to recent



NEMA Standards for more compact design. Complete housing and end-brackets are of solid cast iron.

Specifications: Motors are now in production on 182, 184, 213, and 215 frames. Larger sizes will soon be available. Motors to previous NEMA design frames 203 through 505 remain in production.

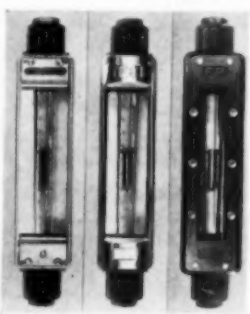
Electro Dynamic Div.
General Dynamics Corp.
Bayonne, N. J.

Circle 173 on Reader Service Card

FLOWMETERS ... with increased visibility

Designation: 1700 Series Flowrator Meter

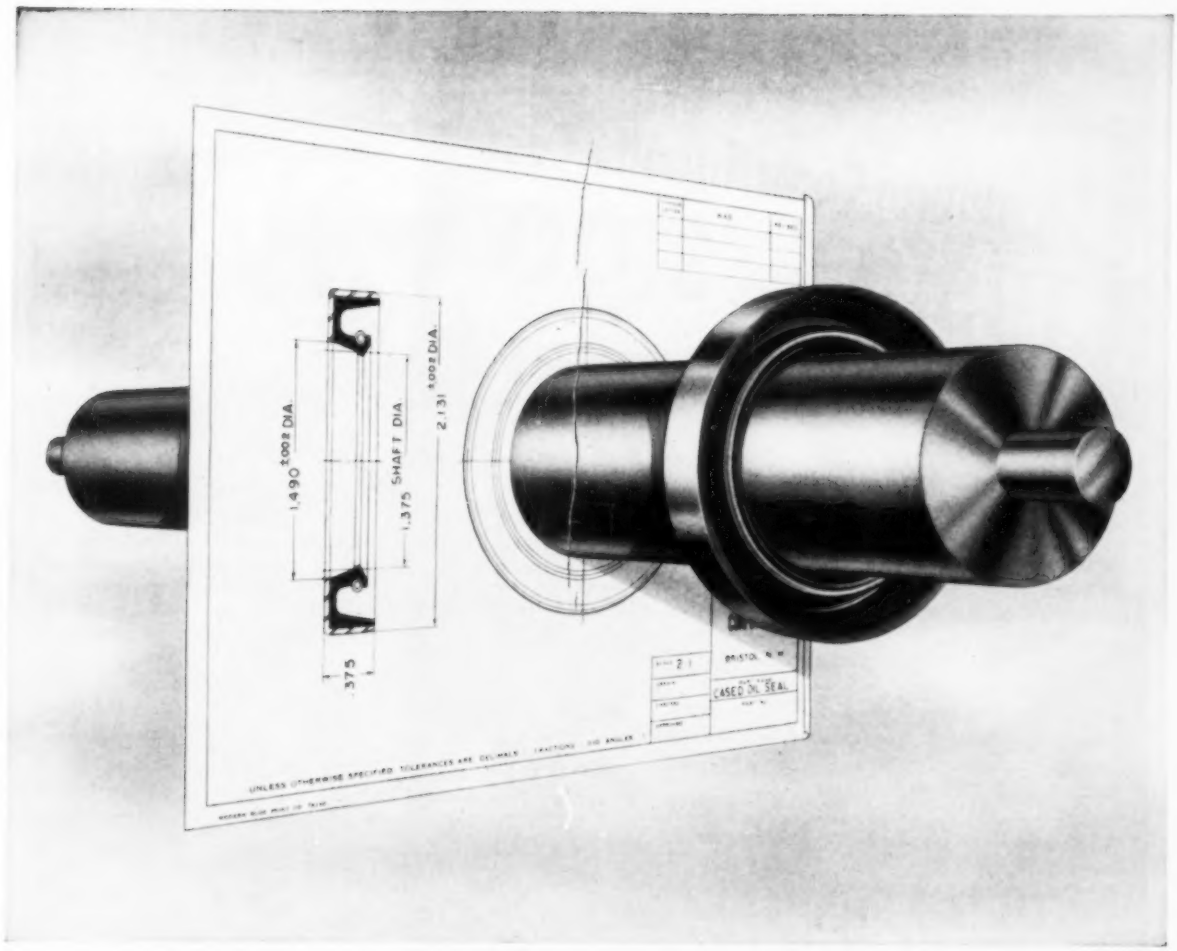
Design: One basic frame can be made into an enclosed or pressure-sealed meter with a quick change



of covers. Enclosed meter is made of stainless steel. New built-in panel mounting fittings allow flowmeters to be mounted quickly and easily on a panel without attaching special mounting fixtures.

Construction: Improved packing assembly is available in either Neoprene or a hat-type Teflon glass-to-

Continued on page 56



Out of IPC Design . . . IPC Performance

Practical performance . . . because IPC packings will be designed to fit your application.

This performance can be your case story when you call IPC; *first* to analyze your problem and *second* to manufacture the correct packings to solve it. IPC analysis includes a complete study of packings function — fluids involved — temperature — pressure, etc. If needed, a special compound will be developed to suit exactly the conditions which the packing must withstand.

Specially developed packings leathers and treatments or custom synthetic rubber compounds are available to fill your packings need. The name IPC insures performance. Write IPC today.

INTERNATIONAL PACKINGS CORPORATION

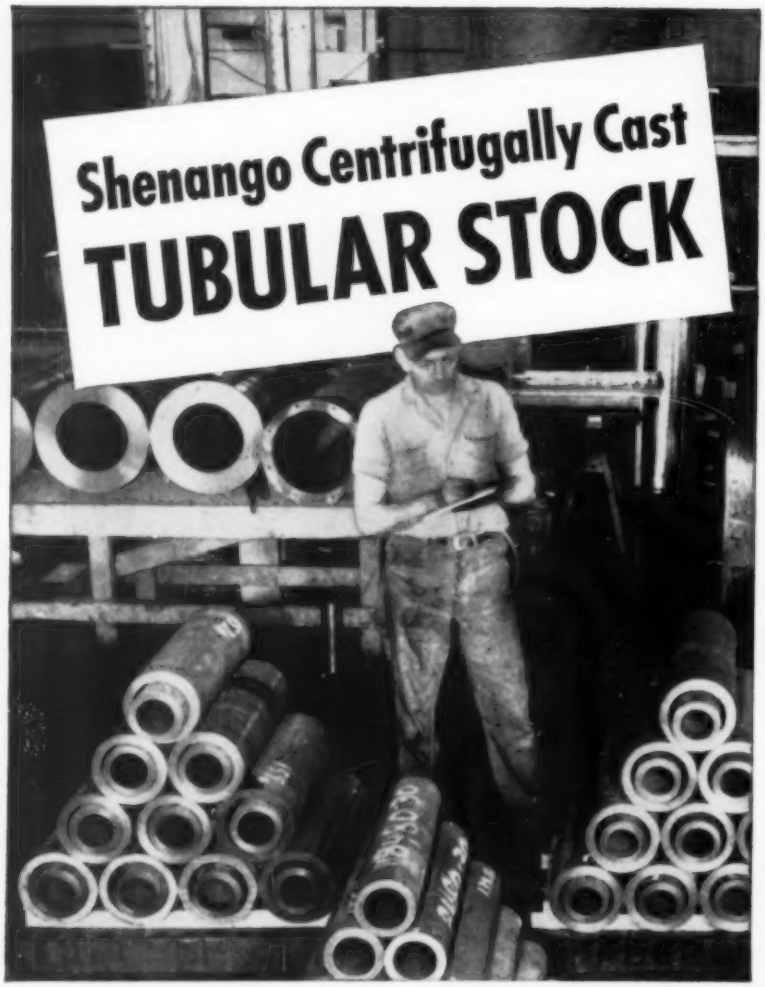
Bristol, New Hampshire

Branch Offices: Chicago, Dallas, Detroit, Kansas City, New York, Philadelphia, San Francisco, St. Louis.

BONDED BY IPC

1. Bonded Washer Seal Double Lip Wiper
9. Bonded Case Seal Straight Lip With Garter Spring
2. Bonded Case Seal Double Lip Wiper
10. Bonded Case Seal Limited Contact Lip With Garter Spring
3. Bonded Washer Seal Straight Lip
11. Bonded Case Seal Straight Lip Thin Rind Type
4. Bonded Washer Seal Limited Contact Lip
12. Bonded Case Seal Limited Contact Lip Thin Rind Type
5. Bonded Washer Seal Straight Lip With Garter Spring
13. Rubber Covered Bonded Case Seal Straight Lip
6. Bonded Washer Seal Limited Contact Lip With Garter Spring
14. Rubber Covered Bonded Case Seal Limited Contact Lip
7. Bonded Case Seal Straight Lip
15. Rubber Covered Bonded Case Seal Straight Lip With Garter Spring
8. Bonded Case Seal Limited Contact Lip
16. Rubber Covered Bonded Case Seal Limited Contact Lip With Garter Spring

P2



...ideal for severe hydraulic service!

In standard tubular stock, as in special cylinders and other made-to-order components, the Shenango centrifugal casting process makes a world of difference. Centrifugal action forces impurities out of the molten metal, prevents inclusions and porosity, and assures a more uniform, *pressure-dense* grain! Thus the metal is stronger, more wear resistant, and machines to a superior finish.

Shenango tubular stock in both bronze and high strength Meehanite Metal is made in a complete range of I.D. and O.D. sizes and in lengths up to 20 feet, depending on diameter, to minimize cut-off waste.

For detailed bulletins or sales-engineering service write to Shenango-Penn Mold Company, Centrifugal Castings Division, Dover, Ohio.

SHENANGO CENTRIFUGAL CASTINGS

COPPER, TIN, LEAD, ZINC BRONZES • ALUMINUM AND MANGANESE BRONZES
MONEL METAL • NI-RESIST • MEEHANITE® METAL • ALLOY IRONS

Circle 134 on Reader Service Card

New Products / continued

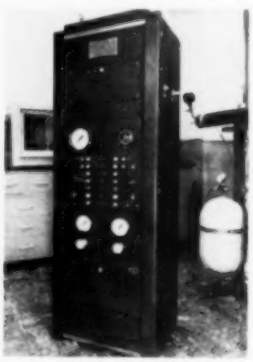
metal seal with Neoprene compression rings. Stuffing box adjustment has slotted bolts allowing for screw driver as well as wrench adjustment. Square, one-piece packing gland follower is stronger, has fewer parts, and allows for more uniform compression.

Fischer & Porter Co.
Hatboro, Pa.

Circle 174 on Reader Service Card

CONSTANT FLOW PUMP . . . for 10,000 psi

Designation: Model 155
Features: Pump fulfills need for continuous, smooth delivery of constant flow at high pressures and maintains a constant rate of flow regardless of discharge pressure up to 10,000 psi. Air pressure operates the high pressure discharge valves



and the hydraulic driving pump which operates two double acting hydraulic cylinders. The action of these two cylinders is controlled by servo valves.

Design: Pump can be operated manually or automatically and a special gear box allows selection of 40 different flow rates ranging from 10cc per hr. to 600 cc per hr. All parts of the pump that come in contact with fluids are of monel or stainless steel. Pump is enclosed in a metal cabinet and all controls are on front panel. Safety features permit unattended operation.

Exline Engineering Co.
Tulsa, Oklahoma

Circle 175 on Reader Service Card

For more NEW PRODUCT reviews turn to page 139

'VSG' *Infinitely* VARIABLE SPEED GEARS

Regd. Trade Mark

'VSG' HYDRAULIC TRANSMISSION GEARS

No. 1 PAPER MACHINE

Papeteries de Roquefort

When the French Company, Papeteries de Roquefort, completely rebuilt the No. 1 Paper Making Machine at their Roquefort (Landes) Paper Mill, 'VSG' hydraulic transmission gears were installed on each of the 11 sections of this machine.

PUSH BUTTON CONTROL

Remote push button stations control the speed of the machine as a whole and provide individual speed trimming at each section.

Full details of this application of 'VSG' drives will be sent on request

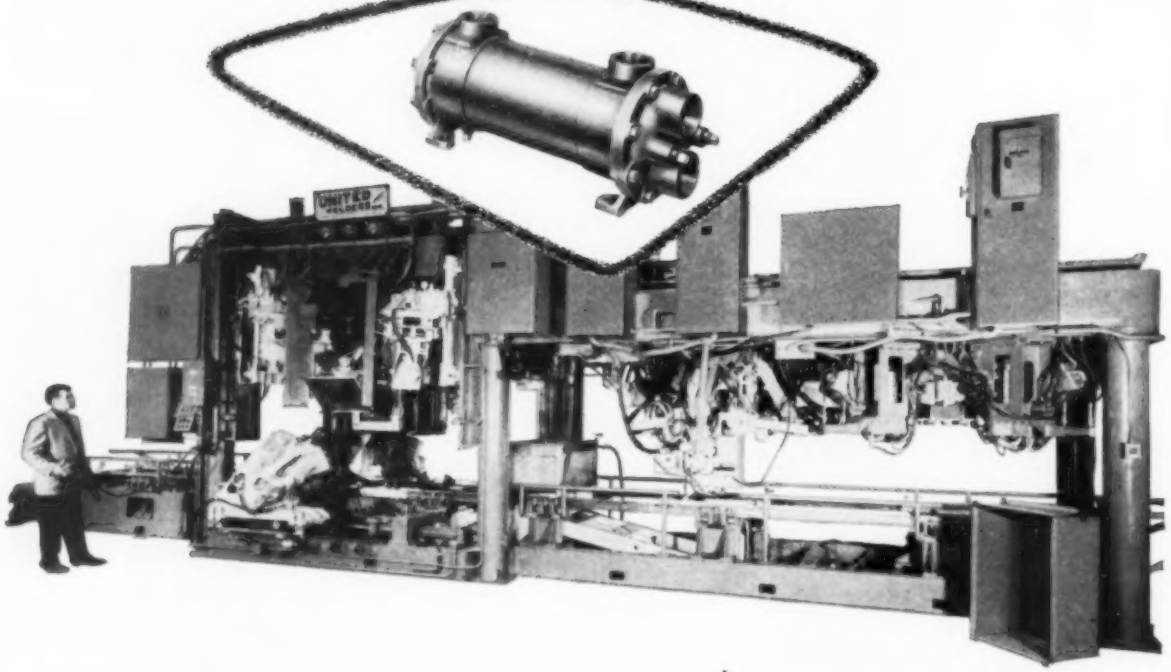
VICKERS-ARMSTRONGS (ENGINEERS) LTD

VICKERS HOUSE · BROADWAY · LONDON · ENGLAND Cables: Vickerseng, London Telex

East: Consolidated Engines & Machinery Co. Ltd., 5645, Pare, Montreal, Quebec and 14th and Birmingham Streets, New Toronto, Ontario
West: Galbraith & Sulley Ltd., 1331 West 6th Avenue, Vancouver, 9

ROSS EXCHANGER

cools oil while this United Welder mass-produces 200 refrigerator liners per hour



Completely automated, this United Multi-Station, Seam, Spot and Projection Welder transfers, locates, folds and welds 200 refrigerator liner assemblies per hour.

To maintain constant seam weld carriage speeds by preventing pump slippage from overheated, thinned oil, a Ross Type BCF Exchanger has been installed as original equipment. Although high pressures are developed in the folding and clamping operations, hydraulic oil temperatures won't vary from the "norm." *Efficient cooling is assured!*

The Ross Exchanger was selected, according to United Welders, Inc., "because it is economical, dependable and easy to maintain". Installing Ross Exchangers has become a regular habit of numerous manufacturers building hydraulic machinery of every description. It's the sure way of providing the utmost in thermal efficiency without expensive "specials" in either engineering or fabrication.

Rugged Ross Type BCF Exchangers are pre-engineered and fully standardized in a wide range of sizes to meet most needs.

For detailed information, request Bulletin 1.1K5.

ROSS

EXCHANGERS

ROSS HEAT EXCHANGER DIVISION
of
AMERICAN-Standard
1464 West Avenue • Buffalo 13, N. Y.
In Canada: Kewanee-Ross of Canada Limited, Toronto 5, Ont.

compact · rugged · reliable

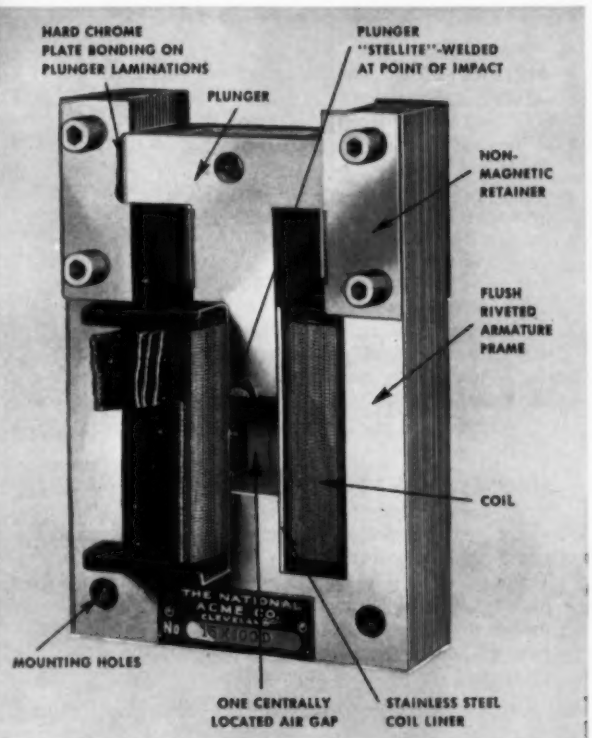
NAMCO *"Stellite"-welded*

solenoids

assure positive, dependable action, with simplified manufacturing and maintenance

on jobs like these

- actuate clutches
- operate switches
- control machines
- print identifying symbols
- operate safety devices
- eject work in process
- actuate clamping
- move levers
- operate valves
- vibrate cutting knives
- open and close doors
- hold chucks
- open and close hoppers
- sort inspected parts



Namco Solenoids, with "Stellite"-weld plunger contacts are built in a wide range of standard sizes (2½ to 21 lbs. at ½" stroke and 4 to 25 lbs. at 1" stroke); in push type, pull type, or combination push-pull type. They are available for either AC or DC service, and with standard or special terminal blocks and mountings.

Other types of units for special application are also available—and experienced engineering assistance, to assure the most satisfactory application of Namco solenoids as a thoroughly dependable part of your product, is yours for the asking.

WRITE FOR BULLETIN EM-52. It gives complete engineering data, as well as suggestions for selection of the proper types. Also shows construction and design features and typical applications.

ELECTRICAL MANUFACTURING DIVISION

THE NATIONAL ACME COMPANY

186 EAST 131st STREET • CLEVELAND 8, OHIO

Useful Literature

For your free copy of publications reviewed, fill in the reader service card

AIR VALVES . . . which are solenoid actuated are detailed in Numatics Operating Valves Catalog No. 8000 and supplementary bulletins. This material describes the company's line of valves including 4-way single and double solenoid types, direct and pilot operated, spool and in-line types. Also included is information on manual valves of various types. The SA valve is a 4-way unit with a corrosion-resistant steel spool and sleeve with full pipe area for pressures to 250 psi. The SR4 series is a 2-position, 4-way valve, single-solenoid controlled, pilot operated with automatic pressure return. The DS4 is a 2-position 4-way valve for control of double acting cylinders where the piston always moves to the extreme limits of its stroke.

Circle 220 on Reader Service Card

FIRE RESISTANT FLUID . . . Information on installation and maintenance of Houghto-Safe fluid for use where potential fire hazards exist is contained in a new 8-page bulletin released by E. F. Houghton & Co. Technical data is given on installation relating to packings, pumps, strainers, filters, and other parts of the system. The importance of pumping at low temperature and storage stability are also covered. Typical uses of the fluid are suggested.

Circle 221 on Reader Service Card

AIRCRAFT PRESSURE SWITCHES . . . and float switches are shown in Bulletin 101 presented by Gorn Aircraft Controls. Eight types are illustrated with a short statement of the principal features. Included is the GP-12000 Series switch with a high cycle life under adverse environmental conditions. The switch is designed with a universal type mounting which is readily adaptable to most installation designs.

Circle 222 on Reader Service Card

FLEXIBLE SLEEVES . . . Seven schematic drawings to show methods for installing flexible sleeves are presented in Bulletin MIS-56 offered by A & A Manufacturing Co., Inc. The bulletin shows the use of ordinary hose clamp fasteners for tightening down around the end collars of vertical sleeves. Another design for anchorage in tight places is the use of a band of soft wire fabricated into the end seams of the sleeve. A third idea employs an inside flange design with capscrew and washer. The flange locks tightly to the sleeve and releases readily when adjustments or replacements are to be made.

Circle 223 on Reader Service Card

SILICONE PRODUCTS . . . including diaphragms, gaskets, oil seals, and rings are the subject of an educational booklet presented by Garlock Packing Co. Features and advantages of the material are outlined, and products manufactured by the company are indicated with recommended applications. Outstanding features of silicone rubber are its ability to withstand high and low temperatures; resistance to sunlight, ozone and aging; low compression set; excellent dielectric properties; and resistance to low-swell mineral oils at high temperatures. Graphs included in the booklet illustrate properties of silicone rubber compared with synthetic rubber.

Circle 224 on Reader Service Card

ELECTRIC MOTORS . . . of The Louis Allis Co. are presented in Bulletin No. 1700. Photos and information is included on open, drip-proof and enclosed, and explosion-proof electric motors manufactured to the new NEMA standards. More than twenty large photographs, including cut-away views and ten explanatory technical drawings and graphs provide essential data on performance and application features.

Circle 225 on Reader Service Card

AIR PUMP . . . and filter manufactured by Dexter Folder Co. are detailed in a new bulletin from the company. The pump is especially designed for applications having low cfm requirements at pressures from 20″ Hg to 10 psi. Illustrations show rotary pump and air filter construction; and specifications give speed, capacity, maximum vacuum, and continuous maximum pressure for three pump models. Data is given for twelve operating conditions ranging from 3.5 to 33.2 cfm. The text explains how sealed bearings prevent oil from getting into the air stream, and covers construction details of vanes, cylinder walls, and side plates.

Circle 226 on Reader Service Card

For more reviews of FREE LITERATURE turn to page 154

Snap-tite's quick-connect "Hi-Flow" coupling delivers maximum flow with minimum pressure drop

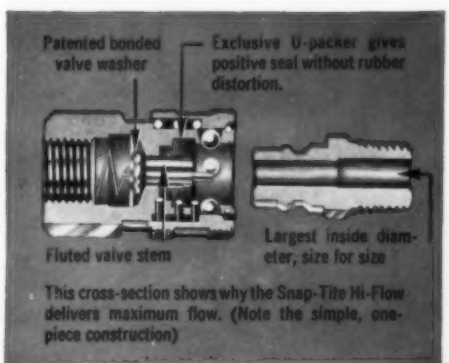
What this test can mean to you

Air tools are designed to operate most efficiently at 90 psi. For every 10 pounds of pressure drop under 90 psi your air tools lose 13% speed and power. If air pressure at your tools is below 90, in spite of a higher reading at your compressor, there are two corrective measures you can take:

One: overwork the compressor to overcome excessive pressure drop of your present couplings . . .

Or Two: install Snap-Tite "Hi-Flow" couplings at each air tool.

Tests run in plants all over America prove "Hi-Flow" couplings lose far less air pressure than any other quick-connect coupling.


Patented bonded valve washer
Exclusive U-packer gives positive seal without rubber distortion.
Fluted valve stem
Largest inside diameter, size for size

This cross-section shows why the Snap-Tite Hi-Flow delivers maximum flow. (Note the simple, one-piece construction)

COMPARE QUICK-CONNECT COUPLINGS

You can set up this quick-connect coupling test in 5 minutes in your plant . . . better still, let your Snap-Tite representative show how really efficient quick-connect couplings increase production and maintenance efficiency in your plant. WRITE

Snap-tite

UNION CITY 1, PENNSYLVANIA

Circle 136 on Reader Service Card

You are LOOKING at a PUMP

. . . of the highest character in the field of industrial hydraulics for continuous pressures to 3000 p.s.i.

For this reason, we use this pump with our controls as the "heart" of our heavy duty hydraulic systems; it is a measure of the quality of equipment and performance that we can offer you.

Specifically, take a look at what the particular pump and control shown can do:

(1) Variable discharge is provided which can be remotely controlled in an infinite range from zero to maximum for positive speed control of cylinders without dissipating power.

(2) Discharge is also reversible, smooth and shock free, eliminating the need for directional control valves.

(3) No relief valves, either pilot or full pressure, are needed in the hydraulic circuit because the control is of the complete pressure compensating type.

(4) Pressure compensation is provided in both directions of discharge.

(5) Pressure can be infinitely and independently adjusted in both directions of discharge over the full operating range.

Please note that all of the above features are available in a single control, which is one of many available to meet countless job requirements. And this represents just one advantage of LASSMAN systems and equipment . . . there are many more which we would be pleased to discuss with you.

Quality EQUIPMENT for *Quality* PERFORMANCE

BENJAMIN LASSMAN & SON Route 8, GLENSHAW, PA.

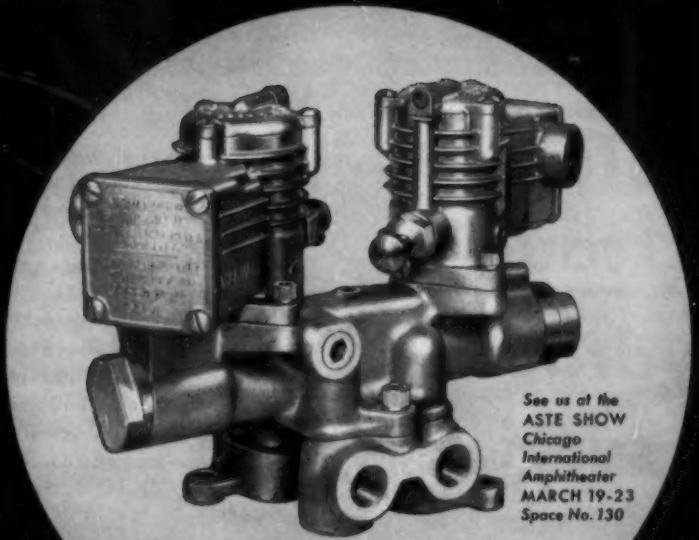
SPEED KING

the only valve guaranteed against coil burnout for life

Now—for the first time—you can eliminate coil burnout, the major source of valve trouble. That's because Speed King valves are *guaranteed against coil burnout for the life of the valve*. Unique design of Speed King valves minimizes inrush and holding current in solenoid coils. Furthermore, coils are encased in molded epoxy resin . . . proof against moisture, oil, dust and vibration.

And the Speed King gives you many other "plus" advantages, too. Users report Speed Kings regularly operate over 20 million cycles. In addition to being guaranteed dependable, Speed King valves are built to JIC standards . . . are compact . . . easily adapt to any requirements for air, hydraulic or vacuum applications . . . have full line of optional attachments . . . *and are available for immediate delivery from stock.*

Check your valve requirements critically. Check performance, features, materials, guarantee, delivery. Compare—and you'll specify Speed Kings. Valvair Corporation, 454 Morgan Avenue, Akron 11, Ohio.



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TOOLING IDEA

A hydraulically driven drill will lunge when it breaks through the work. How much it will lunge depends on amount of compression in the oil, stretch in machine members and the steps taken in circuit design to minimize the resulting spring action.

SURGE CONTROL

. . . on tool feed circuits

• By James Tankard

BY "surge", we mean the reaction on a piston to the sudden loss of resistance to forward motion. This happens when a drill breaks through the bottom of a hole, or when intermittent load is encountered with broaching and milling operations. When this sudden loss of resistance occurs, the piston tends to leap forward. This motion, though short, is sudden and will cause trouble with tooling.

The control of surge depends on the type of volume control being used. When using a meter-in circuit, a counterbalance valve which is mounted in the forward stroke return line from the cylinder, controls surge. This valve sets up an adjustable backpressure on the work side of the piston. This backpressure will do a fair job of controlling surge on light applications. However, when thrust loads are high, the counterbalance valve can't be set to prevent a surge.

This use of a counterbalance valve is also made with the bleed-off control circuit shown in Figure 1. Because pump pressure will vary with load, the bleed-off control is more efficient than the usual meter-in and meter-out circuits where the pump is always operating at the relief valve setting. The backpressure setting for the counterbalance valve which is usually used will vary between 75 psi and 300 psi. The pump is always working against this extra backpressure, and more horsepower is required than would otherwise be necessary.

More dependable control of surge can be developed by the use of the meter-out circuit shown in Figure 2. The adjustable, pressure compensated orifice in the flow control valve sets up a backpressure which reacts against the piston to stop surge. This backpressure is high when the work load is zero. This circuit is not efficient. Horsepower must be available to work against the backpressures developed, and the whole circuit must operate at relief valve setting at all times.

The circuits shown in Figures 1 and 2 provide proper control of the feed cylinder on many jobs; however they have faults which, under certain operating conditions, make them unsuitable. It is necessary to fully understand the causes of breakthrough surge in order to see these faults.

Hydraulic oil, like any other fluid, will compress under heavy loads. These compression forces, exerting an outward pressure in all directions, are contained by reaction forces set up by the stretching of all components which contain the oil. Therefore, the piping expands; the cylinder expands lengthwise and in diameter; and every part of the hydraulic system is under extreme tension. When the load is suddenly released, every member returns instantly to its original form. The reaction of this motion is to force the piston to lunge forward.

All of these forces are, of course, contained between and absorbed by the fixed members of the machine. The machine, no matter how rigidly built,

JAMES TANKARD, *Zagar Tool, Inc., Cleveland, Ohio*

SURGE CONTROL ON TOOL FEEDS

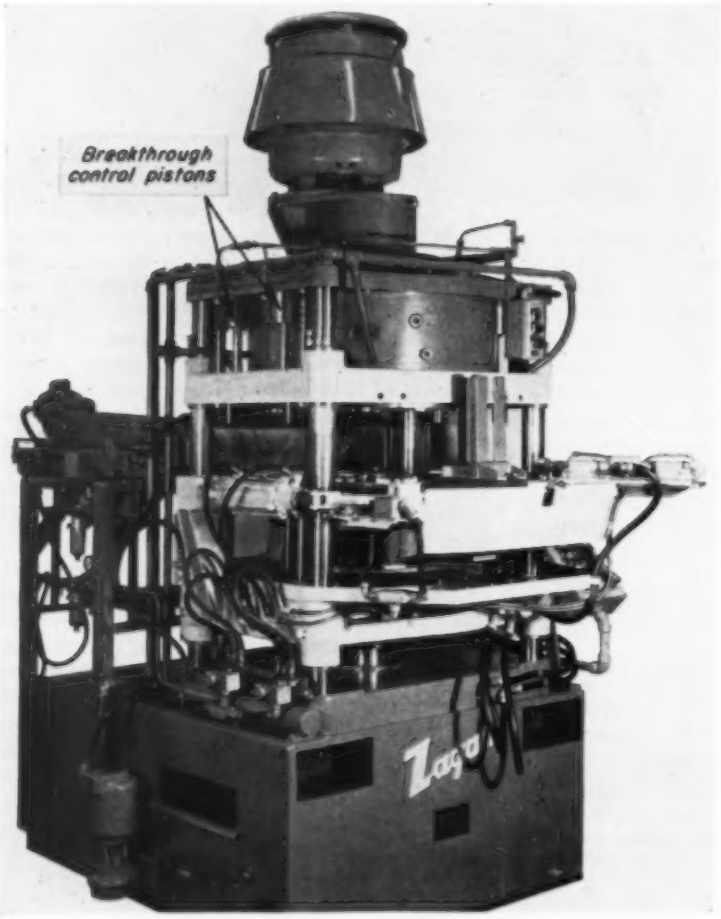
will tend to stretch apart under these forces. If it were possible to entirely stop the forward motion of the piston at the very moment of breakthrough, the drills might be damaged by the reaction to the sudden release of load—the "spring-back" of the machine itself. To prevent damage to the drills, the hydraulic surge of compressed oil and the mechanical surge of the stretched machine members must be controlled. The meter-out flow control valve cannot do this by itself.

A pressure compensating device is used in the flow control valve. As we know, the volume of oil through a fixed orifice will depend on the pressure drop across it. The pressure compensating device will maintain a fixed pressure drop across the orifice to allow a constant volume of oil to pass through regardless of the amount of work load. However, this adjustment requires movement. Time is needed to complete this movement. When the drill breaks through, the work load suddenly drops and the compensator cannot move fast enough to prevent a spurt of oil from going through the valve. Because of this time lag in compensator action, the circuit will not perform well when large forces are liberated suddenly.

In the development of machines on which large multiple spindle drill heads are mounted, Zagar Tool engineers were confronted by this surge control problem in exaggerated form. There is no practical limit to the number of drills it is possible to mount in a Zagar drill head. Heads have been built with as many as a thousand drills. The thrust required to drill several hundred holes becomes great —25,000 to 30,000 pounds is not unusual. This thrust force is released instantly when the drills break through.

The circuit shown in Figure 3 has overcome the surge problems inherent in circuits shown in Figures 1 and 2. During most of the cycle, this is a simple bleed-off circuit which has high efficiency with low horsepower requirements.

At a predetermined point before breakthrough, the circuit becomes a combination of bleed-off and meter-out in which the speed is controlled by the bleed-off, and the surge is controlled by the meter-



BECAUSE OF THE SURGE CONTROL circuit developed for this multi-spindle drilling machine, no lunge is detected when the more than 400 small diameter drills break through the work.

out. Because of the location of the components, the mechanical surge is also controlled.

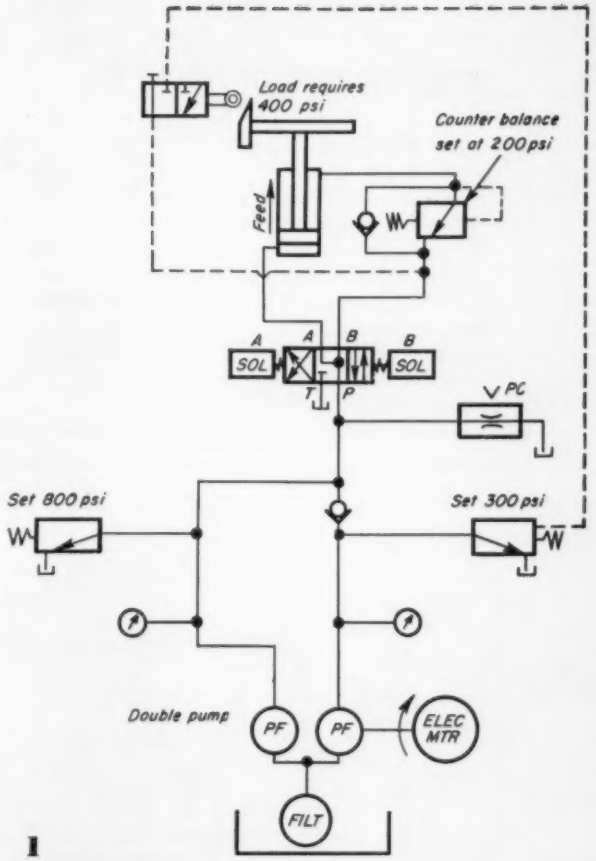
Oil is pumped into the circuit by a double pump. Each unit is controlled by its own relief valve. On the fast approach of the drills to the work, oil from both pumps is directed into the cylinder. The circuit contains a shut-off valve, mechanically operated, which is piped into a line between the return line of the cylinder and the vent port on the large pump relief valve. At a predetermined point, before the drills contact the work, the shut-off valve is opened by cam action. This vents the relief valve, allowing the oil from the large pump to flow direct to tank and only the oil from the small pump to enter the cylinder. A check valve between the pumps prevents loss of oil from the small pump. A bleed-off type flow control can be adjusted to set the speed of the forward motion of the drills.

Four small cylinders are mounted on the top stationary member of the machine. These are single acting cylinders with one line from each cylinder going into a common line which leads back to the 4-way valve. This line contains an adjustable orifice —a needle valve—with a bypass line through a check valve which permits free flow in the other direction.

At a predetermined point before breakthrough in the upward stroke of the ram, contact will be made with the piston rods to force the pistons up. Oil from all four pistons is forced through the fixed orifice which is adjusted to allow the proper amount of oil to flow through with a predetermined back-pressure.

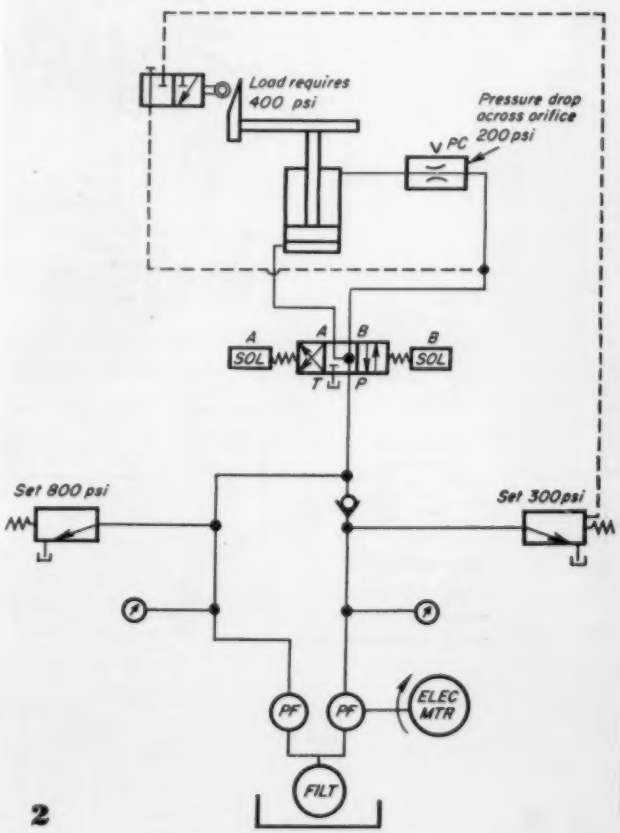
HOW THE CONTROL IS ADJUSTED

Here is the procedure for adjusting the surge control circuit. First, the bleed-off flow control valve is adjusted to obtain the feed rate desired under no load. With the adjustable orifice in the line from the four upper pistons kept wide open, the pressure required to do the drilling job is determined by reading the gage while drilling. By way of example, let us say the pressure reads 400 psi. Now, restrict the orifice until the gage reads 600 psi. In this way, 200 psi of backpressure is set up on the load side. This back pressure plus the load is all being absorbed between the top and bottom stationary members of the machine. The relief valve is set at about 800 psi pressure so that no flow is



1

FIG. 1. COUNTERBALANCE valve provides a back-pressure to minimize surge caused by drill breakthrough. It is not effective when thrust loads are high.



2

FIG. 2. USING A METER-OUT circuit to regulate tool feed also creates a sizeable backpressure. However, on breakthrough, there's a small time lag before the compensator in the flow control valve shifts to cause increased backpressure. During this instant damaging surge can occur when there are high hydraulic and mechanical forces released.

SURGE CONTROL ON TOOL FEEDS

going through the relief valve while under normal load.

At the moment of breakthrough, most of the 400 psi liberated will be absorbed by the orifice. It is not possible to maintain a constant volume of oil through a fixed orifice under varying pressures, but, in this case, where a sudden surge of pressure and the movement of a relatively large volume of oil through the orifice occurs, it will almost entirely stop any forward surge. This same principle is used when cushioning cylinders.

On the return stroke of the main cylinder, oil is forced into the four upper cylinders by means of a sequence valve as shown. A 50 pound check valve will do as well.

This circuit has several advantages over the others shown in Figures 1 and 2. Throughout most of the stroke, the circuit is a standard bleed-off type which is the most efficient. Only the horsepower required to do the job is being used. The mechanical surge or spring-back is controlled by placing the cylinders between the two members taking the load. The hydraulic surge is almost completely stopped.

On an application of this circuit, where over 400 holes are drilled in stainless steel, movement of the ram is so steady, it is not possible to tell at what moment the breakthrough occurs. ▼▼▼

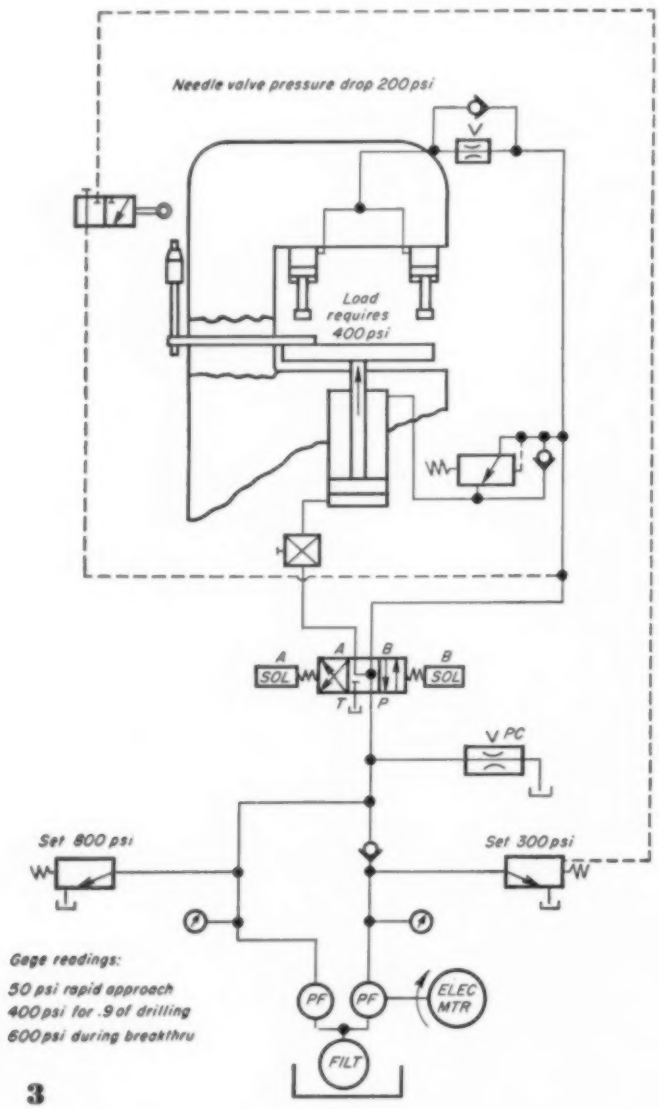
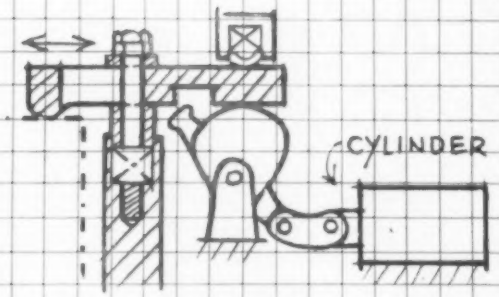


FIG. 3. SURGE CONTROL is achieved with this circuit. There's no backpressure on the feed cylinder until a moment before breakthrough when four upper pistons are contacted. Backpressure is then created by the non-compensated needle valve with restricts flow out of the four pistons.

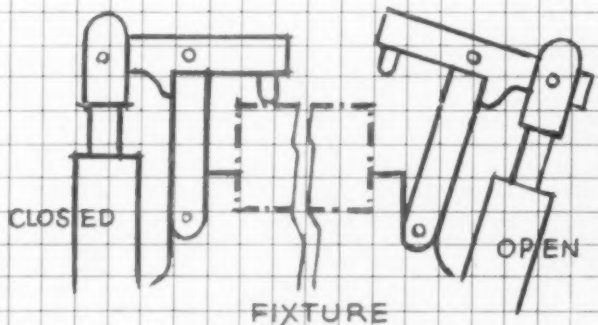
Designer's Sketchpad of Fluid Powered Mechanisms

Here are 30 ideas to help you use air and oil cylinders to power clamping, index, feed, transfer, and reciprocating motions. The sketches show how cylinders can be connected to drive the tooling.

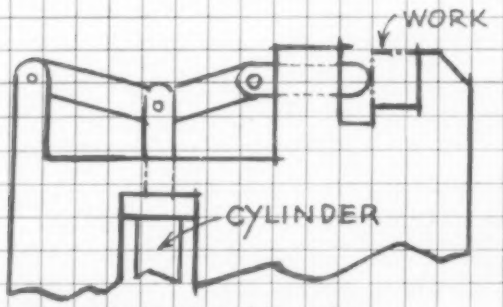
CLAMPING



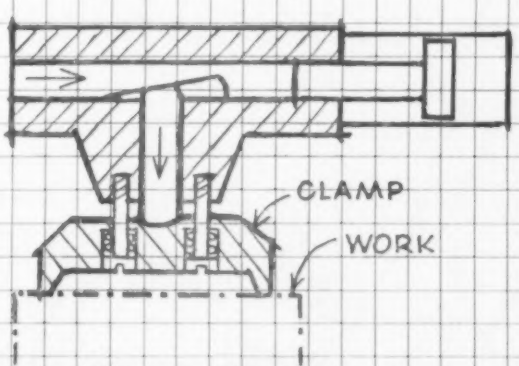
When cylinder is retracted, finger engages slot in clamp to extend clamp over work. Further retraction of cylinder causes rotation of cam to rigidly clamp work.



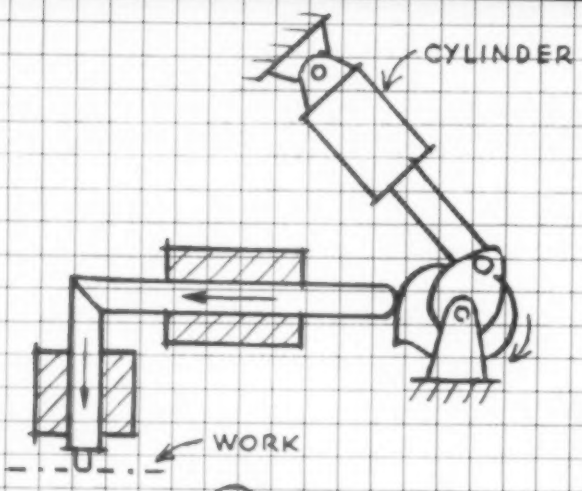
Swinging clamps can be easily powered by air or oil cylinders and arranged to open far enough to permit lifting work from fixture.



Toggle mechanism is widely used on clamping fixtures for large mechanical advantage and mechanical locking feature.

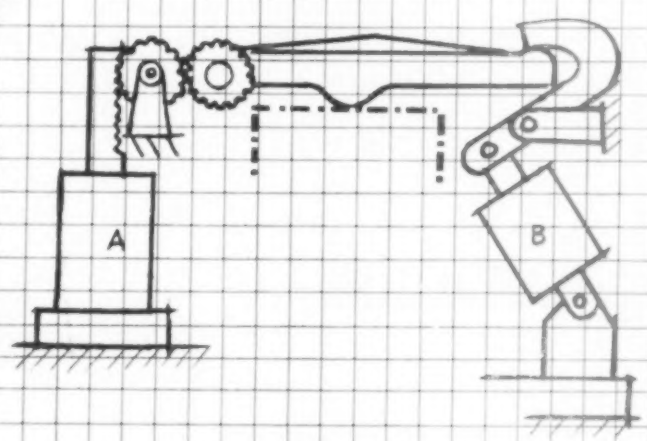


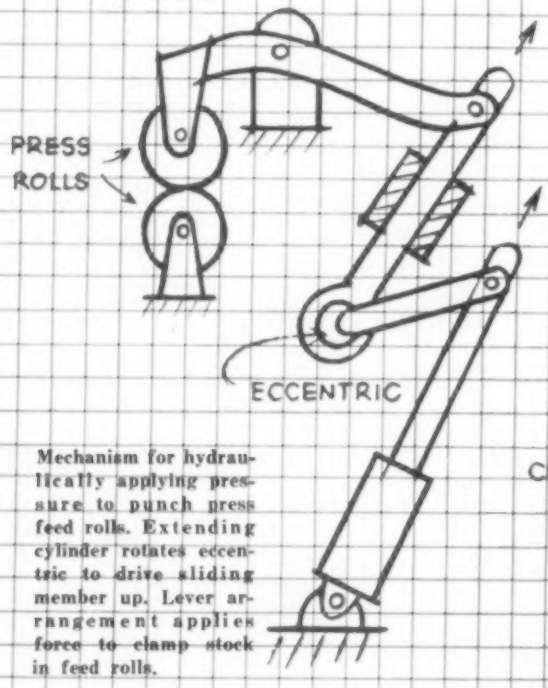
Retracting cylinder forces wedge against pin to clamp work. Spring-loaded clamp is returned when cylinder is extended. The clamp floats so that it will seat against a rough-surfaced workpiece.



Cylinder extends to force cam against horizontal member. Force is directed downward against work by sliding surface.

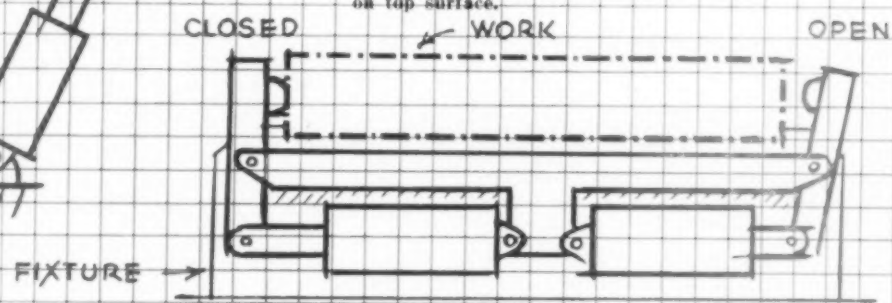
Cylinder A opens and closes clamp through rack and pinion. Cylinder B locks clamp in closed position.



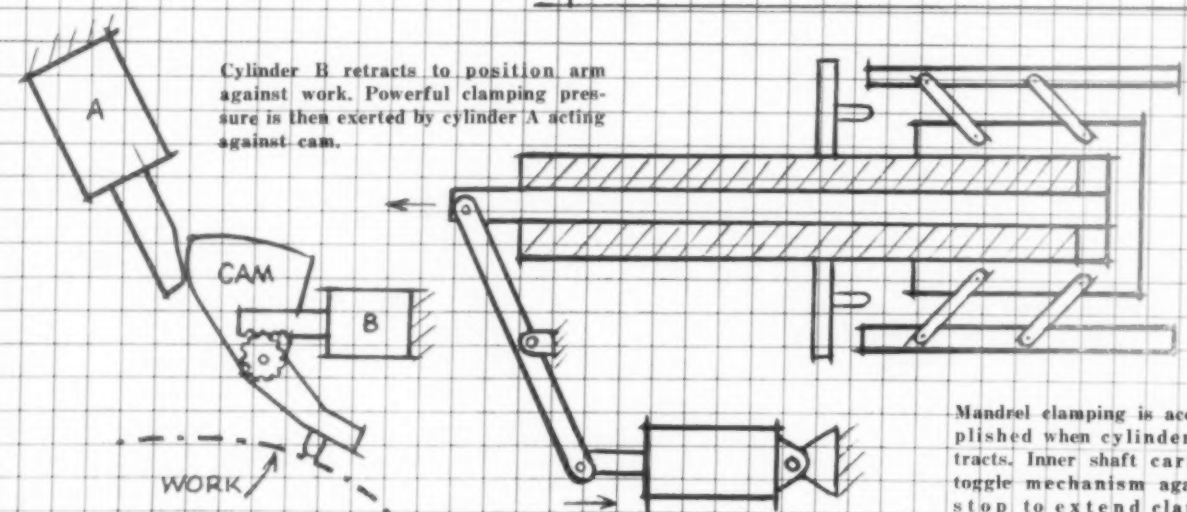


Mechanism for hydraulically applying pressure to punch press feed rolls. Extending cylinder rotates eccentric to drive sliding member up. Lever arrangement applies force to clamp stock in feed rolls.

Two cylinders below work power side clamps. This arrangement eliminates any interference with cutting tools working on top surface.



Cylinder B retracts to position arm against work. Powerful clamping pressure is then exerted by cylinder A acting against cam.

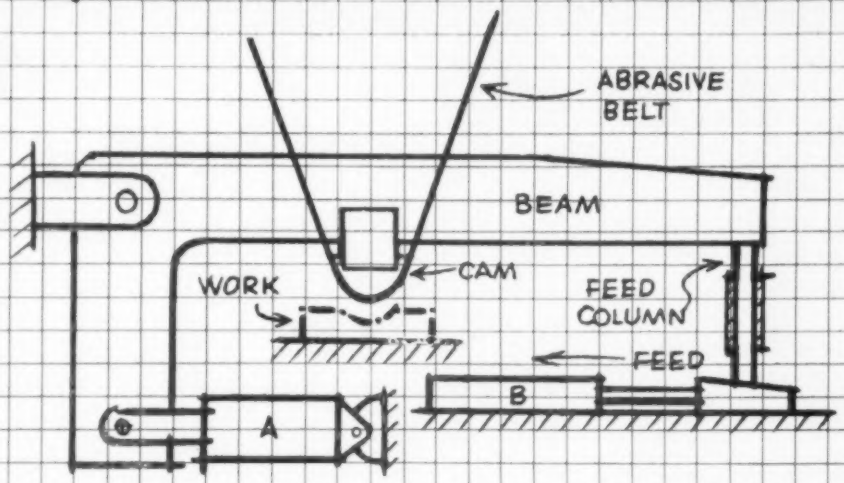


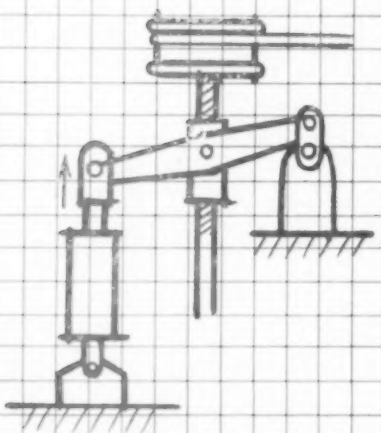
Mandrel clamping is accomplished when cylinder retracts. Inner shaft carries toggle mechanism against stop to extend clamps against work.

Designer's Sketchpad of Fluid Powered Mechanisms

FEED

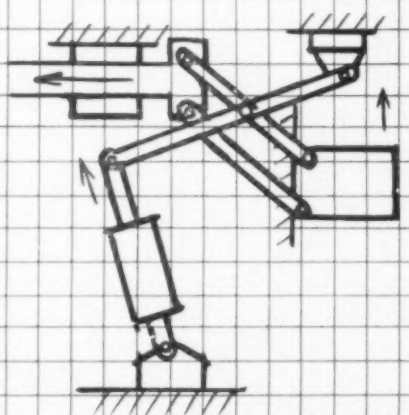
Belt type grinder uses cam for grinding to required shape. Extension of cylinder A advances cam toward work until wedge stops feed column. Retraction of cylinder B moves wedge to provide fine feed.



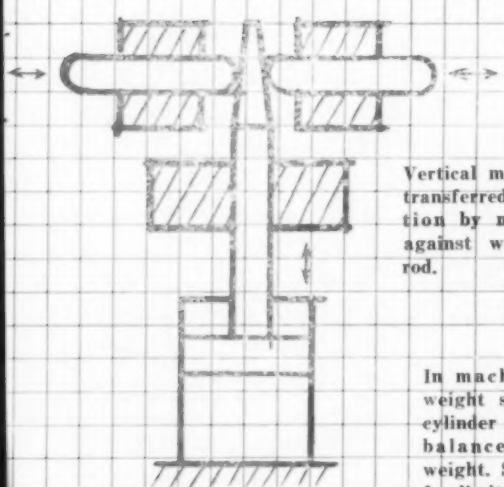


Fast rotary motion is provided by cylinder actuating lever to turn steep screw.

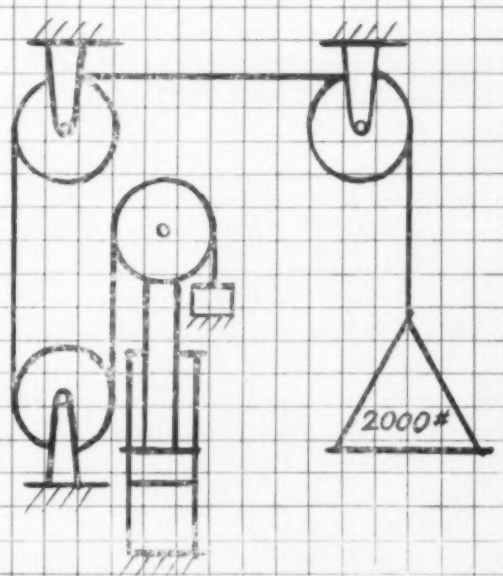
Horizontal-parallel motion is provided with ratchet and gear segment. Top slides restrict motion to horizontal.



Straight-line motion in two directions is provided by slides which guide loads vertically and horizontally.



Vertical motion of piston is transferred to horizontal motion by members bearing against wedge on cylinder rod.

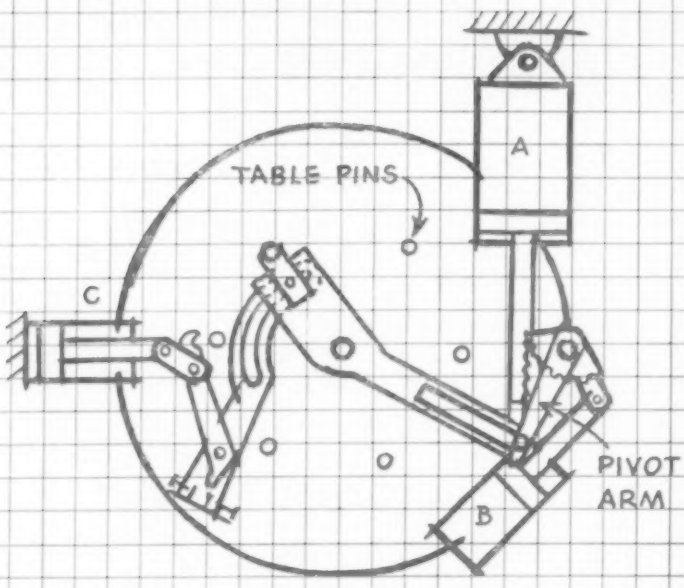


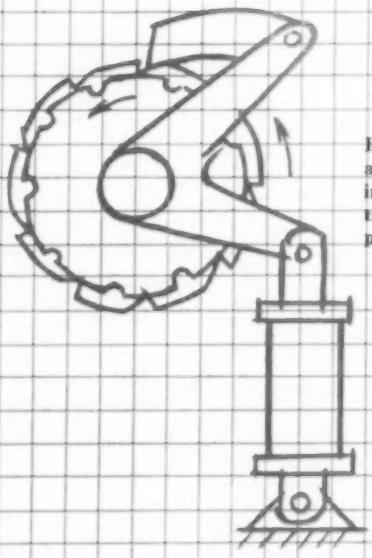
In machine tool counterweight system, pressure on cylinder blank end counterbalances 2000-lb overhung weight. System was selected for limited space application.

Designer's Sketchpad of **Fluid Powered Mechanisms**

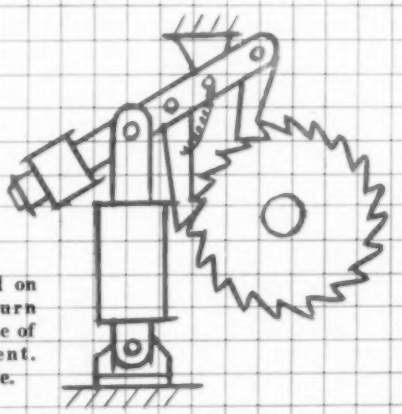
INDEXING

Cylinder A retracts to rotate pivot arm clockwise. Pivot arm sliding in main drive arm rotates main arm and table counterclockwise. Cylinder B acts as cushion to slow table at end of stroke. When table is indexed, cylinder C extends to lock table and actuate slide in main drive arm to unlock it from table. Cylinder A extends to reset mechanism for next index.





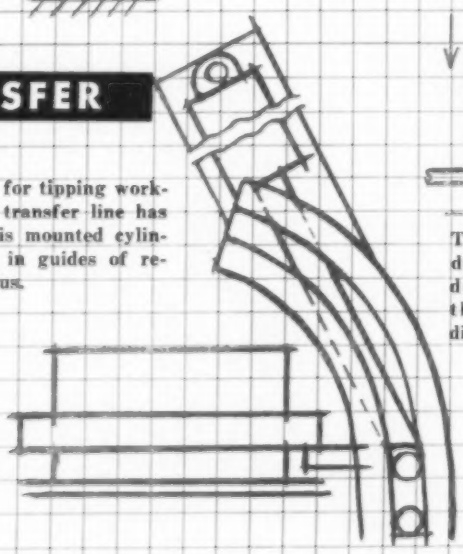
Ratchet type indexing mechanism translates linear cylinder motion to rotary motion. Clevis mounted cylinder permits proper motion.

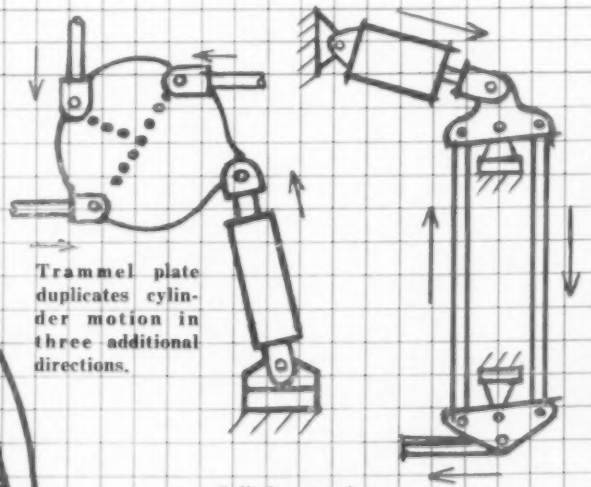


Indexing is accomplished on both forward and return stroke of cylinder, because of double pawl arrangement. Rapid indexing is possible.

TRANSFER

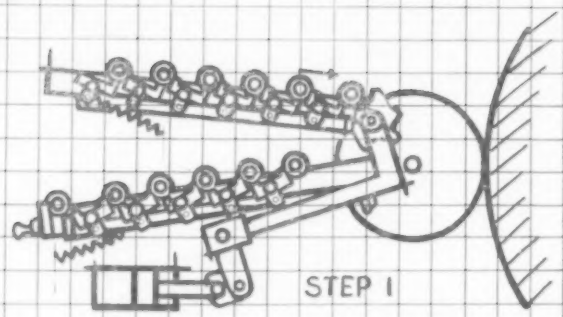
Mechanism for tipping workpiece on a transfer line has rod of clevis mounted cylinder sliding in guides of required radius.

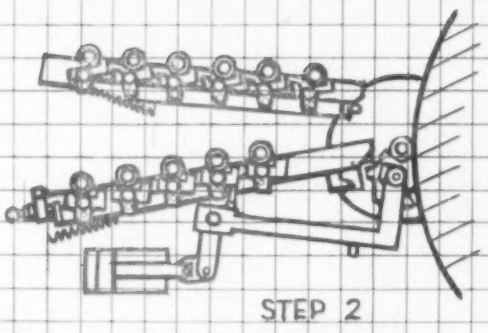


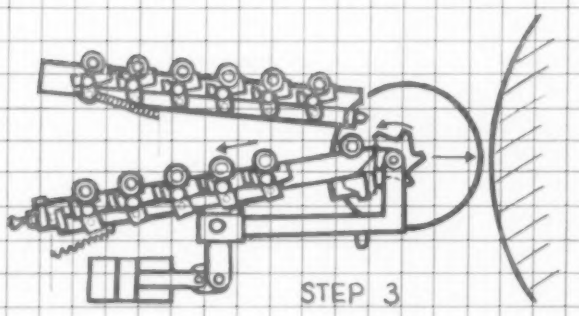


Trammel plate duplicates cylinder motion in three additional directions.

Cylinder motion is transferred to remote point by pantograph mechanism.







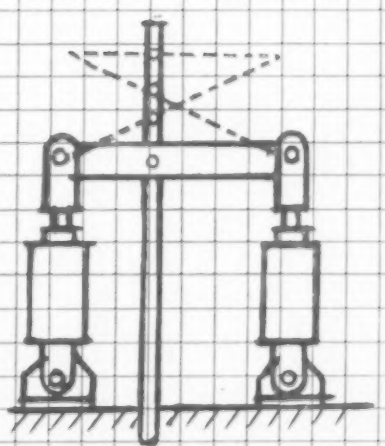
Work holding and feeding fixture for automatic grinding of shafts.

Step 1. Cylinder fully extended, shaft rolls into work-holding sprocket.

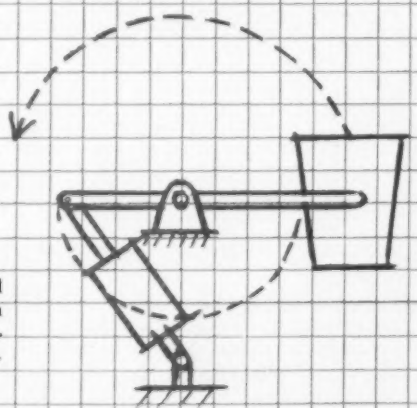
Step 2. Cylinder retracts, shafts advance. Work piece is held against wheel.

Step 3. Cylinder partially extended.

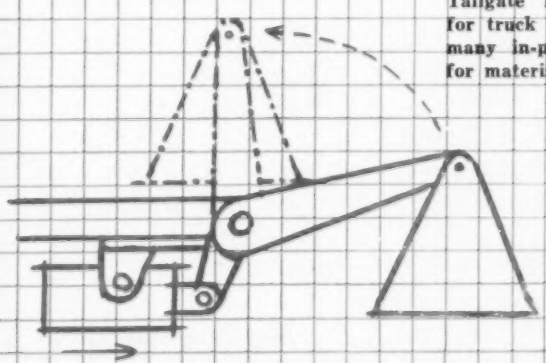
Workpiece removed from wheel. Finished and unfinished shafts advance.



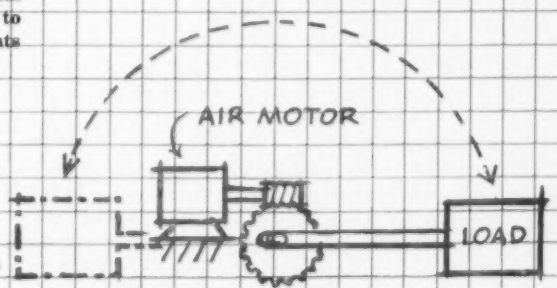
Four positive positions of center rod are obtained by having both cylinders retracted, both extended, and either one retracted while the other is extended.



Air cylinder transfers load through arc. Moving from top position, container produces negative load on cylinder.

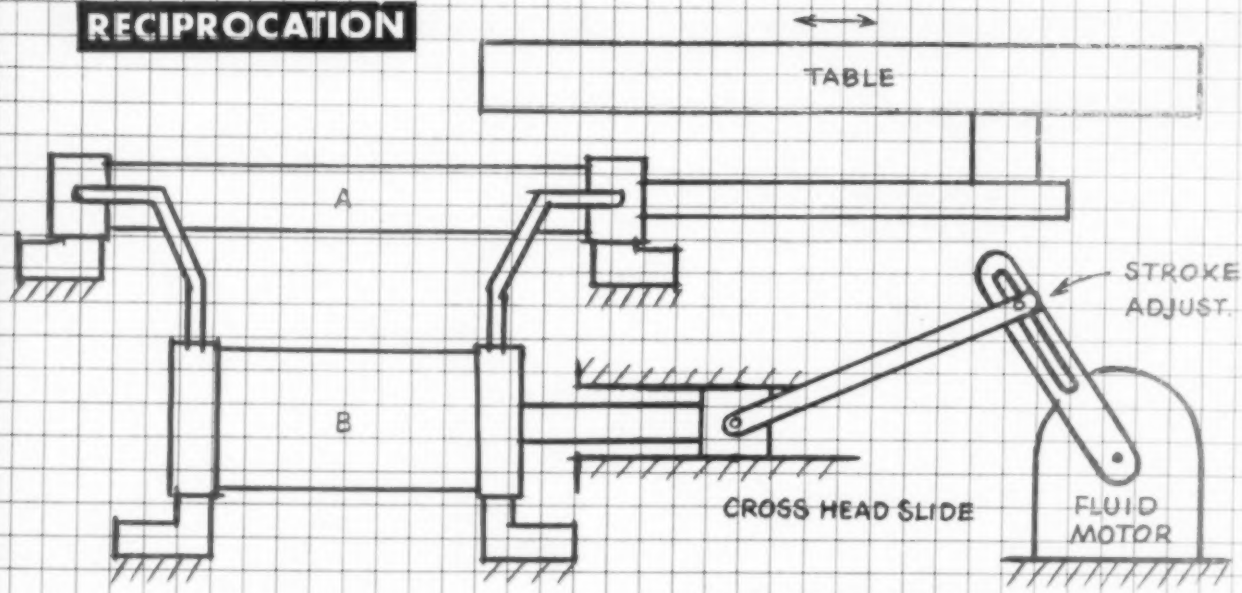


Tailgate loader mechanism for truck can be applied to many in-plant requirements for material handling.



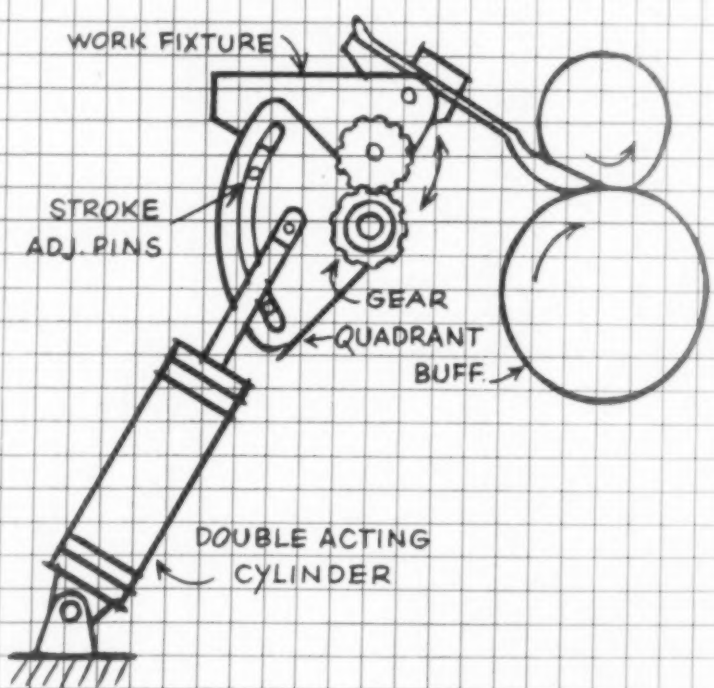
Air motor driving worm gear permits transferring load through arc.

RECIPROCATION

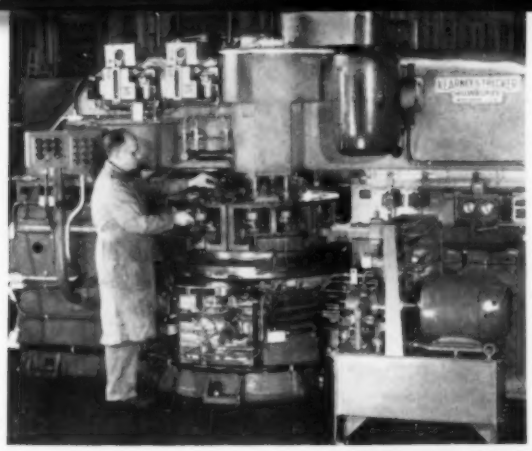


Fluid motor drive reciprocates table with harmonic motion, the stroke being adjustable at the motor crank. Speed multiplication is obtained in ratio of cylinder B bore to cylinder A bore. Reservoir connection to make up for leakage should be used in this closed system.

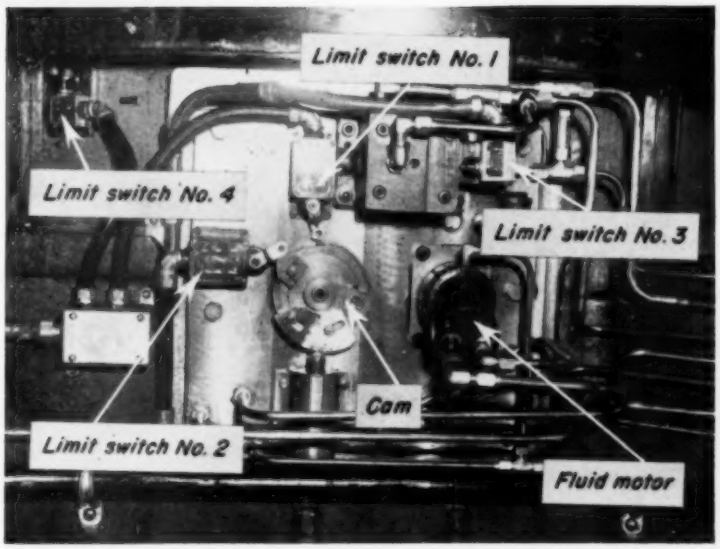
Table is reciprocated by alternately valving oil to cylinder A and cylinder B. Single cylinder could be used if equal speeds in both directions are not required.



Reciprocation of the double acting cylinder is controlled by a 4-way valve tripped by the stroke pins. Oscillation of work fixture occurs as work fixture pinion rocks around pinion on cylinder-powered quadrant. This mechanism was devised for buffing silverware.



TOOLING IDEA



ELECTRICALLY CONTROLLED hydraulic circuit provides a smooth simple drive for index table on this automatic machine. Deceleration valve and two limit switches are actuated from a cam geared to a fluid motor drive.

CAM SEQUENCED INDEX TABLE

... with fluid motor drive

• By M. L. Hutchens and J. Finley

STANDARD tooling which can be adapted to various production set-ups is appearing in increasing numbers. Hydraulic drill heads, feed slides, and index tables are three such tooling units. Along with this trend, engineers at Kearney & Trecker Corp., Special Machinery Div. have designed a rotary index table driven by a fluid motor. The table is sequenced by limit switches and a deceleration valve actuated by a cam geared to the fluid motor drive. This hydraulic actuation provides a smooth accurate movement. Slowing down and stopping the table at the end of its travel is accomplished with the deceleration valve which is connected to meter the fluid motor discharge.

The index table consists of four major components: table, center post, sub-base, and gear box. The cast iron table mounts hydraulic clamping fixtures which are piped through the table center post. The center post acts as a manifold to apply pressure to clamping units mounted on the table. The center post also incorporates the hydraulic cylinder for lifting the table during rotation and clamping after index. The sub-base is of cast iron construction and furnishes bearing support for the table. The center post and gear box are mounted on this sub-base. The self-contained gear box contains all table drive and index mechanisms. To position the table accurately, an index pin automatically locks the table in

M. L. HUTCHENS, *Chief Engineer*, J. FINLEY, *Design Engineer*, *Kearney & Trecker Corp., Special Machinery Div., Milwaukee, Wisconsin.*

each index position. This pin is withdrawn during rotation.

The index table is made in four diameters of 36, 48, 60, and 80 inches. Any number of indexes up to 9 is available on the 36 and 48-inch sizes. Ten indexes are available on the 60-inch size and 12 indexes are available on the 80-inch size. Because each component can be easily removed for repairs and there are no internal connections, maintenance is simple. An inspection panel in the lower base section gives easy access to the center post.

The index table is powered by a two-pressure combination unit incorporating a small-volume, high-pressure pump; a large-volume low-pressure pump; relief valve; check valve; and unloading valve arranged in the conventional "hi-lo" circuit. The small-volume pump has a maximum output of 2.2 gpm at 1000 psi, and the large volume pump has a maximum output of 7.0 gpm at 1000 psi. The unloading valve for the low-pressure pump is set at 400 psi, and the relief valve for the high pressure pump is set at 550 psi.

The pump unit is mounted with a 3-hp, 1200-rpm motor on a 30-gallon reservoir. Two directional control valves and a sequence valve are mounted on a panel with the pump unit.

Limit switches 1-LS and 2-LS actuated by the cam are mounted on the index table panel. These have a transparent cover for quick inspection of the contacts. The fluid motor is of the fixed displacement, axial piston type with a maximum speed of 2800 rpm at an input of 11.5 gpm.

HYDRAULIC CIRCUIT OPERATION

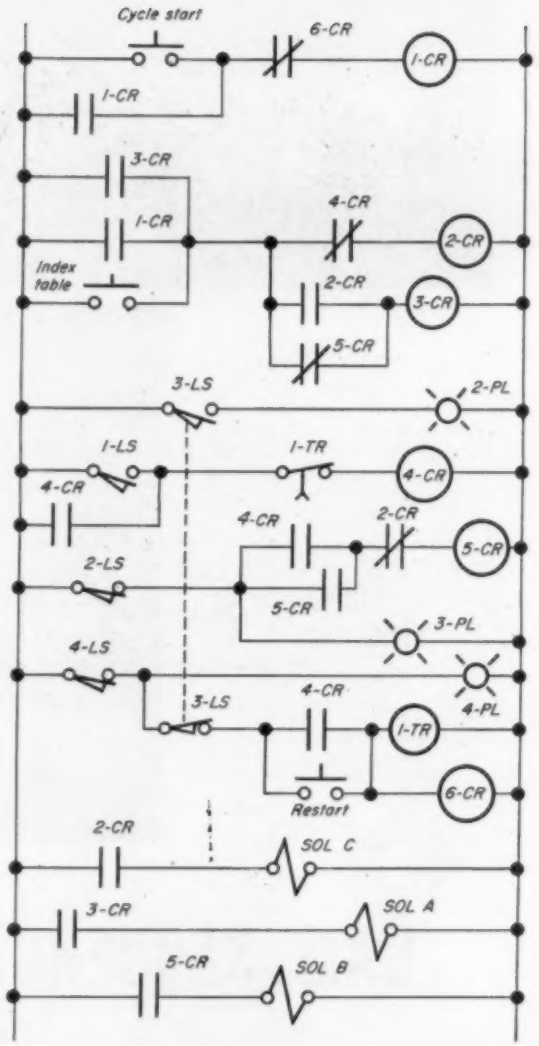
When the cycle is started, solenoid A of valve 2 is energized. This 2-position, 4-way valve is solenoid controlled and pilot operated. Energizing solenoid A directs pump flow to retract cylinder 4 carrying the table locking pin. When port A of cylinder 4 is uncovered, flow is directed to the head end of cylinder 8 in the index table center post. Because this piston is fixed and the cylinder free to move, the table moves up .030 inch for rotation.

With the table up, pressure increases to 275 psi, the setting of sequence valve 3, and flow is directed to the fluid motor.

Solenoid C of valve 6 is actuated when the cycle is started, so that the fluid motor runs at full speed and discharges through this valve and through valves 7 and 2 to drain.

As the index table approaches the next station, limit switch 1-LS is actuated de-energizing solenoid C and directing motor discharge through deceleration valve 7 only. As the cam contacts the deceleration valve, motor output is decreased.

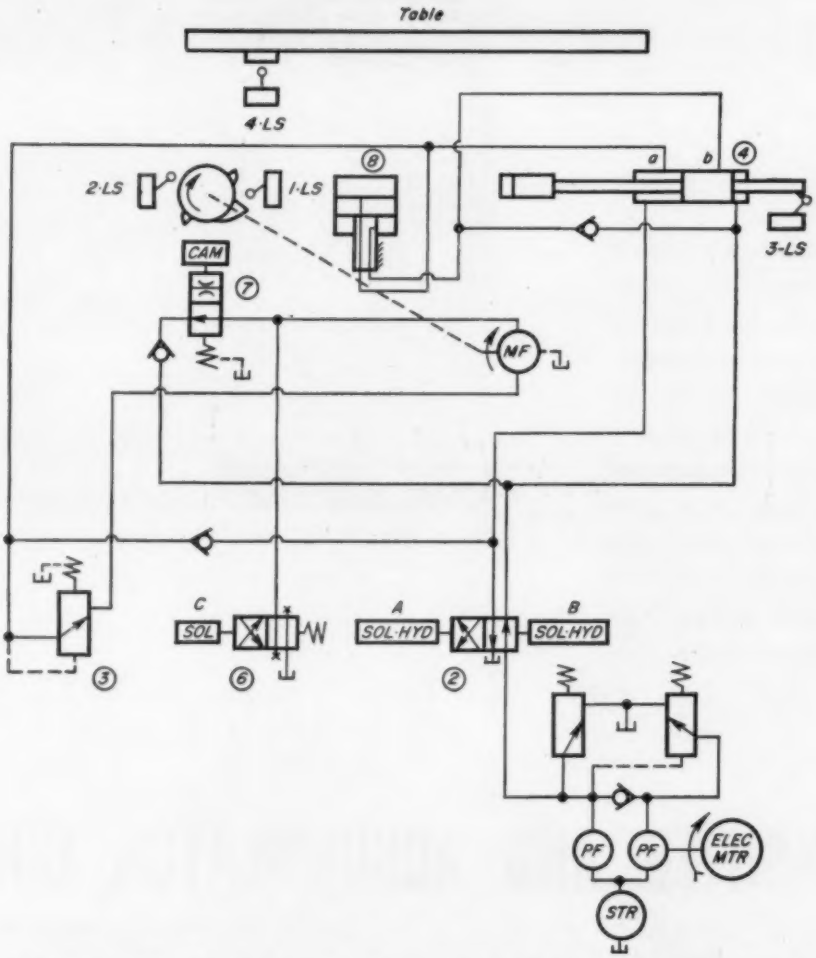
When limit switch 2-LS is actuated, solenoid A is de-energized and solenoid B of valve 2 is energized.



This applies pressure to the motor discharge line stopping the motor. Cylinder 4 moves to the left to insert the locking pin. When port b of cylinder 4 is uncovered, flow is directed to cylinder 8 to lower and clamp the table.

ELECTRICAL CIRCUIT OPERATION

Depressing the CYCLE START switch actuates relay 1-CR which locks in and actuates relay 2-CR. Relay 2-CR energizes solenoid C of valve 6 and also actuates relay 3-CR. Relay 3-CR energizes solenoid A of valve 2. When cylinder 4 is all the way to the right, limit switch 3-LS is actuated lighting a pilot light and opening the timer circuit.



CYLINDER 4 LOCKS TABLE in each index position and also sequences flow to table-lifting cylinder 8 and fluid motor. Cylinder 8 has fixed piston with oil passages to rod and head ends of the cylinder, as well as to clamping units which can be mounted on table.

As the table begins to rotate, limit switch 2-LS is released. Near the end of indexing, limit switch 1-LS is momentarily actuated energizing relay 4-CR which locks in. Relay 4-CR de-energizes relay 2-CR and solenoid C of valve 6 and causes the motor to decelerate.

At the end of indexing, limit switch 2-LS is actuated energizing relay 5-CR. Relay 5-CR energizes solenoid B and de-energizes relay 3-CR and solenoid A. Because the fluid motor discharge line is now at pump pressure, the motor stops completely. Limit switch 3-LS is released and limit switch 4-LS is actuated energizing the timer and relay 6-CR. Relay 6-CR de-energizes relay 1-CR and energizes relays controlling the machine tool feeds of the asssociated machine. When the timer times out, contacts 1-TR open de-energizing relay 4-CR. This de-energizes the timer and relay 6-CR.

TYPICAL APPLICATION

A typical application of the index table is on a production machine for milling and drilling automobile camshafts. Four index positions are used for: 1. loading and unloading; 2. milling both ends of the camshafts to length; 3. center drilling both ends; 4. drilling two holes in one end. The output of the machine is 288 pieces per hour, and the index table turns 90 degrees in 3 seconds. ▼▼▼

Downtime caused by stripper spring failure was a major headache on giant presses used to form and pierce automobile stampings. On this job the metal stock is worked while hot, and pressure pad and stripping forces of up to 20 tons are required. The springs were thrown out and replaced with hydraulic cylinders powered by a specially designed . . .

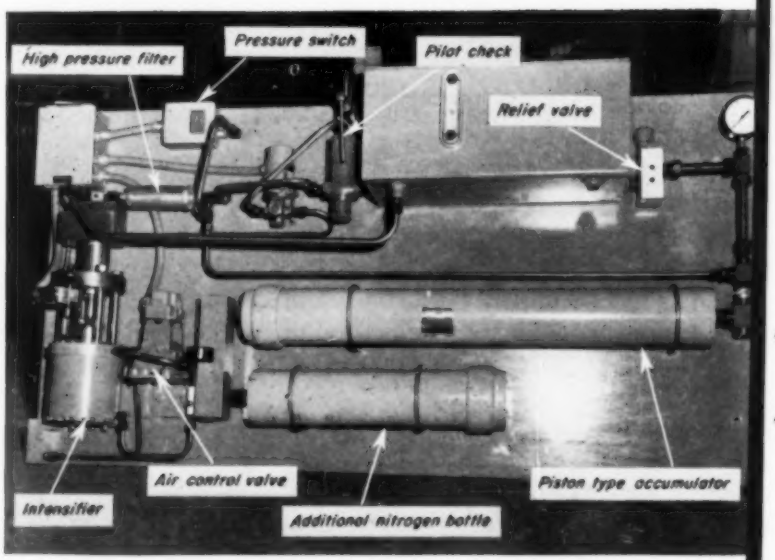


FIG. 1. THIS POWER unit will be mounted on the press frame.

INTENSIFIER AND ACCUMULATOR CIRCUIT

● By E. W. Friedl

CONTINUOUS operation of heavy die springs at 300 F resulted in fatigue failures which led to costly downtime of large hot working form and pierce presses. Space limitations, the stripping forces required and the high temperature made it impractical to design an air powered pressure pad and stripper for this job.

The pressure pad design problem involved a line of presses being used by a supplier of heavy automotive stampings. To solve this problem, specialists in the design and construction of special hydraulic devices and fluid power systems were consulted.

E. W. FRIEDL, *Design Engineer Precision Products, Inc., Cleveland, Ohio.*

Precision Products, Inc., Cleveland, developed a self-contained die loading package which is mounted on the press ram to supply oil pressure to pressure pad cylinders which replaced the springs. The package is designed to supply 12 die cylinders having a 1¼ inch bore and 8½ inch stroke. The number of cylinders used can be varied as required by the tooling. All the components in this circuit are shown in Figures 1 and 2.

SHOP AIR IS USED

Shop air is the initial power source used to drive the intensifier which has an effective ratio of 40 to 1. The intensifier fills the die cylinders and charges the piston type accumulator from which oil pressure is maintained on the die cylinders. An additional nitrogen bottle is connected to the accumulator to provide sufficient gas volume so that during pressure pad operation the rise in gas pressure is

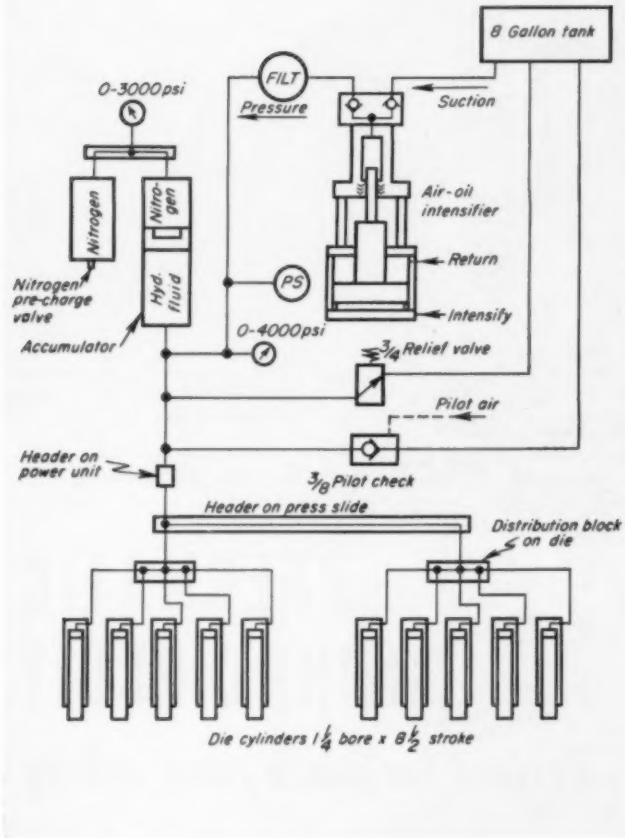


FIG. 2. ARRANGEMENT of hydraulic components.

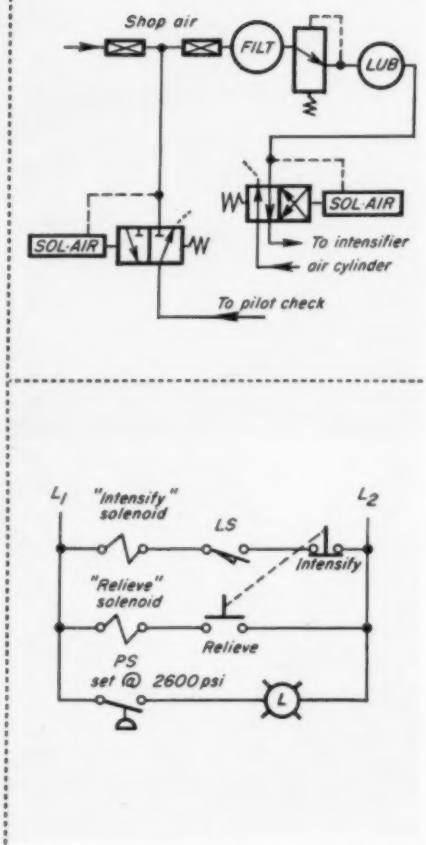


FIG. 3. AIR and electrical control circuits.

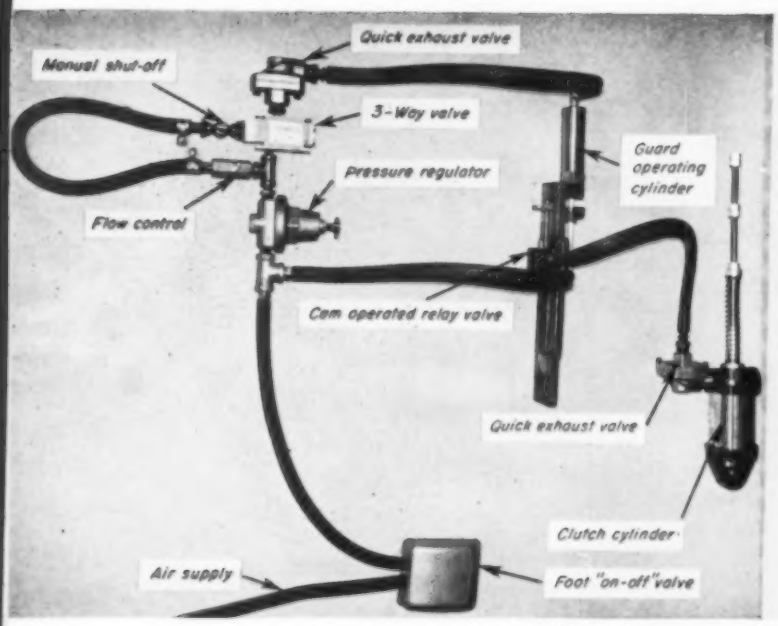
limited to 10% when six die cylinders are used. The rise is 20% when all twelve cylinders are used.

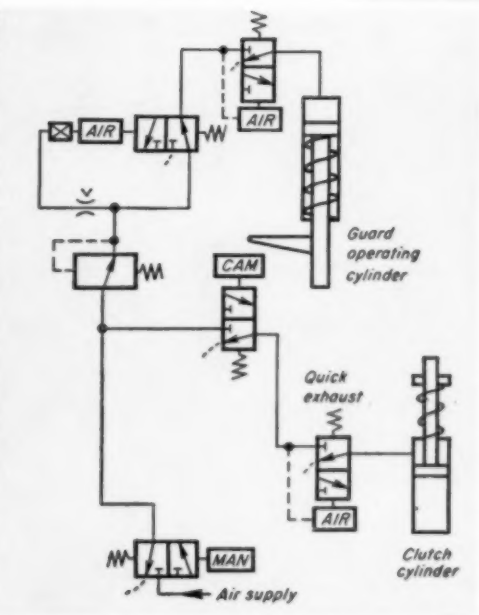
The double acting air driven intensifier is controlled by the simple electrical and air circuits shown in Figure 3. With a nitrogen precharge of 1100 psi, the accumulator is loaded to a maximum oil pressure of 2050 psi to avoid bottoming the piston against the accumulator gas end. If a higher or lower operating pressure is needed, the nitrogen precharge is varied. For this package, nitrogen precharge pressure should equal .548 times the desired maximum oil pressure. A relief valve in the hydraulic circuit limits maximum system pressure to 2800 psi. A normally open pressure switch, set at 2600 psi, will close at this pressure to energize a light or signal bell to warn the operator of excessive pressure.

Stroking of the intensifier is controlled by a limit switch which automatically energizes and deenergizes the 4-way air valve at the extreme ends of air piston travel. To keep the solenoid valve energized for the least amount of time, the solenoid circuit is closed only on the return stroke. Oil pressure in the accumulator is relieved by closing the "relieve" button which at the same time opens the "intensifier" circuit. Closing the "relieve" button energizes the 3-way air valve which directs pilot pressure to open the check valve between the accumulator and reservoir.

HOW ACCUMULATOR IS SELECTED

Selection of accumulator size is based on the displaced oil volume of the 12 die cylinders and the desired gas pressure increase of 20% which occurs as oil from the cylinders is forced back into the accumulator when the press closes. Reserve oil volume in the accumulator is equal to 25% of total oil capacity when the press is open. ▼▼▼





All air components used for control of punch press are shown in the photograph. The JIC schematic illustrates the operation.

TOOLING IDEA

PNEUMATIC TIMING CIRCUIT

. . . devised for punch press safety

• By Clifford J. Lane

SIMPLICITY and safety are proven features of a pneumatic system developed to operate a punch press guard. A sequence of events must take place with accurate timing to prevent the punch press from repeating its cycle of operation and causing serious damage.

When the foot control valve is depressed, air is permitted to flow to the pressure reducing valve and also to the relay valve. However, the relay valve is inoperative until it is tripped by the guard operating cylinder which moves downward to place the guard in position. With the relay valve open, air pressure is then exerted on the clutch cylinder to permit the press ram to operate. This arrangement makes it impossible to release the press clutch before the safety guard is down.

Reversal of the guard operating cylinder will shut the relay valve and cause releasing of the clutch. Timing the reversal of the guard is accomplished by pilot control of the 3-way valve. The spring of the 3-way valve normally holds the spool in a position to permit air flow to the spring returned guard operating cylinder. Therefore, the guard operating cylinder piston moves downward as soon as the pressure has built up sufficiently to overcome the piston return spring. At the same time, air going through the flow control valve exerts a pressure in the air pilot chamber of the 3-way valve. When pilot pressure overcomes spring force, the valve spool shifts to exhaust pressure from the guard cylinder. The guard raises and the press clutch is released with the foot control valve held depressed, air pressure holds the 3-way valve in the exhaust position so that the guard operating cylinder piston is retracted and the relay valve has been released, causing the clutch cylinder to return to its original position. It is impossible for the ram to make further strokes until the foot control valve has been released.

With this circuit, the operator can actuate the punch press for single strokes only. However, if it is desired to operate the press continuously, the manual shutoff valve is closed permitting the spring in the 3-way valve to keep the spool in the "pressure on" position. Through the relay valve, air pressure holds the clutch piston in its depressed position and the press will "roll" until the foot control valve is released.

The flow control valve has proved accurate in its metering, and the adjustment of the flow control valve and the pressure reducing valve make it possible to compensate for inaccuracies in machining and non-uniform frictional characteristics in the various working parts. ▼▼▼

CLIFFORD J. LANE, *Lane Engineering Company, Buffalo, N.Y.*

PUMPS

DEVELOP OIL HYDRAULIC POWER

2 to 100 gpm—continuous duty operation up to 1500 psi—up to 1800 rpm—single or double rotation—constant delivery.

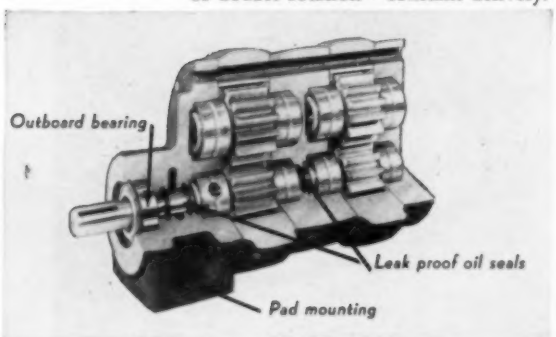


Fig. 1—Two gear pumps assembled in tandem on common shaft deliver independently—can be piped for dual operation or combined for double capacity single operation. "Pressure Pocketing" reduces slippage, friction and wear—volumetric and mechanical efficiency over 90%.

GEAR SIZE	SPEED (R.P.M.)	OUTPUT (G.P.M.) at discharge pressure psi 500	1000	1500	INPUT (H.P.) at discharge pressure psi 500	1000	1500
PC	600	2.3	1.1	0.5	1.2	2.3	3.5
SERIES	1200	4.5	3.6	2.6	2.4	4.5	7.0
1″	1800	7.2	6.0	5.5	3.8	6.7	10.5
PD	600	6.6	6.4	6.3	2.6	4.0	7.0
SERIES	1200	13.2	13.0	13.0	5.2	8.0	13.5
1″	1800	19.3	19.0	19.0	7.5	12.0	20.5
PJ	600	19.4	18.7	18.4	6.2	12.3	18.0
SERIES	1200	41.3	40.6	40.0	12.8	24.7	37.4
2″	1800	62.1	61.0	60.3	20.5	38.6	58.8

Performance data for PC and PD pumps having gear widths other than shown above can be approximated by multiplying values in above table by width of desired gear; for PJ pumps multiply by 1/2 the width of desired gear.

PC SINGLE PUMPS

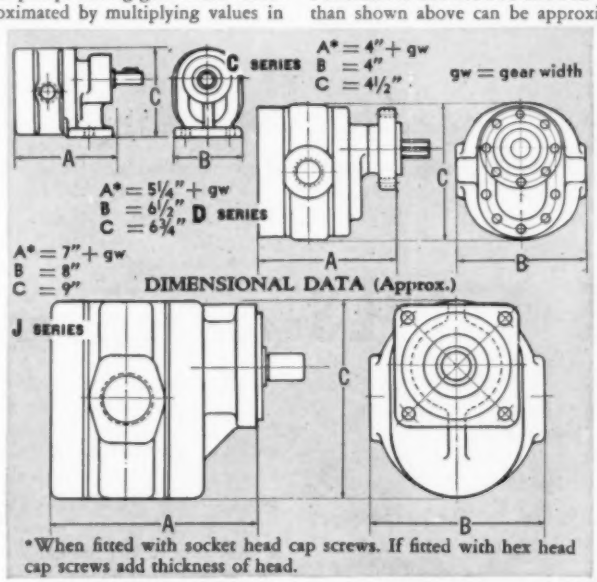
3 gear widths, 1/2″, 1″, 1-1/2″.
4 round shaft sizes.
pedestal and 3 flange mountings.
tapped ports—side or end.

PD SINGLE PUMPS

7 gear widths, 1/2″, 3/4″, 1″, 1-1/2″, 2″, 2-1/2″, 3″
8 round and 3 splined shaft sizes.
pad and 7 flange mountings.
tapped ports—side or end.

PJ SINGLE PUMPS

5 gear widths, 2″, 2-1/2″, 3″, 3-1/2″ and 4″.
1 round and 1 splined shaft size.
2 flange mountings.
tapped or split flange side portings.



*When fitted with socket head cap screws. If fitted with hex head cap screws add thickness of head.

MOTORS

UTILIZE OIL HYDRAULIC POWER

2 to 68 hp—continuous duty operation up to 1500 psi—up to 1500 rpm—single or double rotation—variable speed.

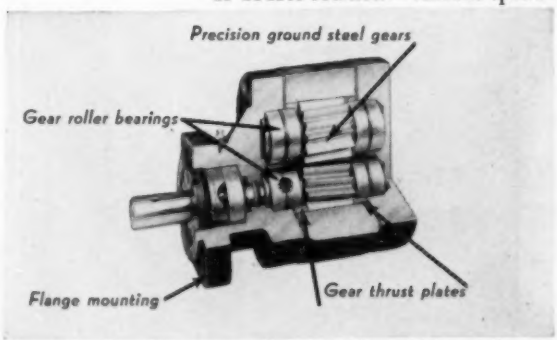


Fig. 2—Single gear motor can be piped from side on end ports. Extra large gear bearings maintain shaft alignment; heavy-duty outboard bearing absorbs drive shaft and shock loadings. New leak-proof oil seals maintain internal pressure balance.

GEAR SIZE	SPEED (R.P.M.)	INPUT (G.P.M.) at input pressure psi 600	1000	1500	OUTPUT (H.P.) at input pressure psi 600	1000	1500
MC	600	0.8	1.4	2.4	4.1	4.7	5.3
SERIES	1000	1.3	2.4	3.4	7.1	7.4	7.7
1″	1500	1.9	3.5	4.5	9.6	10.4	10.8
MD	600	2.1	3.5	4.3	8.2	8.6	9.0
SERIES	1000	3.5	5.8	8.0	12.5	13.6	14.0
1″	1500	4.3	8.0	11.2	18.0	19.0	20.0
MJ	600	5.7	10.2	15.5	21.3	21.8	23.3
SERIES	1000	8.7	15.8	24.9	34.2	35.4	36.9
2″	1500	10.2	21.5	34.3	54.0	55.0	57.5

Performance data for MC and MD motors having gear widths other than shown above can be approximated by multiplying values in above table by width of desired gear; for MJ motors multiply by 1/2 the width of desired gear.

MC SINGLE MOTORS

3 gear widths, 1/2″, 1″, 1-1/2″.
4 round shaft sizes.
pedestal and 3 flange mountings.
tapped ports—side or end.

MD SINGLE MOTORS

7 gear widths, 1/2″, 3/4″, 1″, 1-1/2″, 2″, 2-1/2″, 3″.
8 round and 3 splined shaft sizes.
pad and 7 flange mountings.
tapped ports—side or end.

MJ SINGLE MOTORS

5 gear widths, 2″, 2-1/2″, 3″, 3-1/2″ and 4″.
1 round and 1 splined shaft size.
2 flange mountings.
tapped or split flange side portings.

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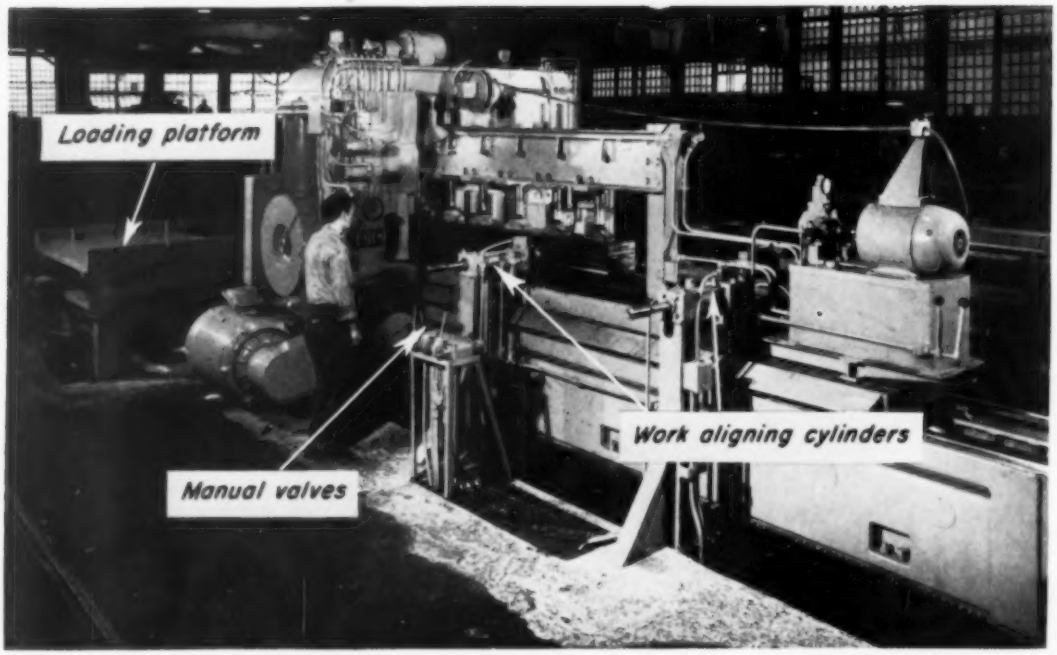


MACHINE HAS BEEN EQUIPPED with hydraulic loading platform and work aligning cylinders. Operation is by manual valves, but safe sequence is assured by shuttle valves and series connected 4-way valves.

Here's the story of a manually controlled circuit for loading work on a milling machine. When motion of a group of hydraulic cylinders is electrically controlled, it's not difficult to arrange interlocks which make the operation of some of the cylinders dependent on others. But how is interlocking to be accomplished on a manually controlled circuit? The answer on this job is to use series connected directional controls and . . .

SHUTTLE VALVES *for sequence control*

• By H. Veith
and W. M. Myers

IN an electrically controlled hydraulic circuit, proper sequencing and interlocking to ensure that certain cylinders cannot operate when others are actuated is easily accomplished with limit switches, pressure switches, or timers. However on a manually operated system with several cylinders, other means of interlocking must be used.

On a dual milling machine recently installed in a steel mill, this problem was solved by connecting directional control valves in series and connecting certain cylinders through shuttle valves.

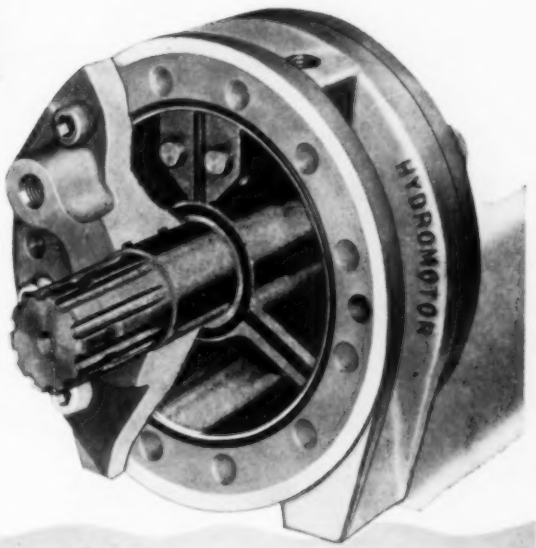
To increase production from a dual milling machine, Jones & Laughlin Steel Corp. working with S. G. Morris Co. designed improved loading and

H. VEITH, *Design Engineer, Jones & Laughlin Steel Corp., Pittsburgh, Pa.* W. M. MEYERS, *Sales Engineer, S. G. Morris Co., Pittsburgh, Pa.*

BONNOT *Hydromotor*

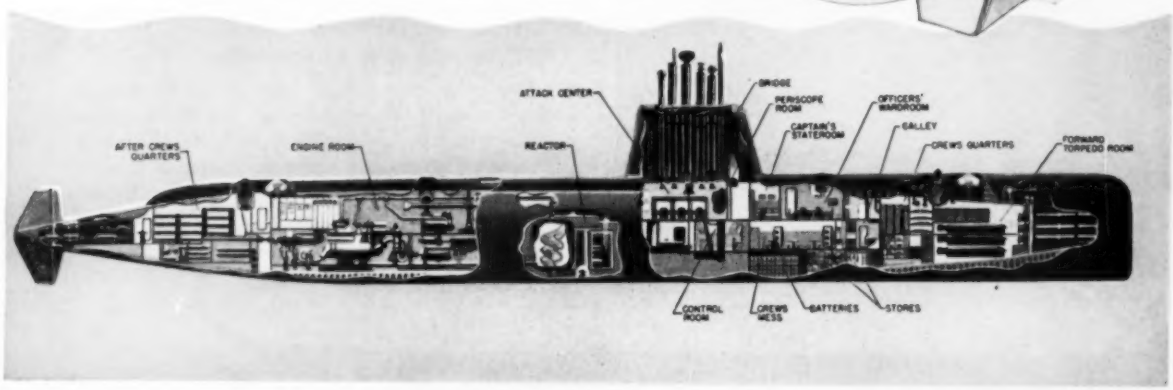
GOES TO THE NATION'S DEFENSE

aboard the *Nautilus*



Aboard the Navy's first atomic-powered submarine Nautilus, the space-saving, weight-saving Bonnot **Hydromotor** is efficiently providing RECIPROCATING ROTARY POWER. And in industry, these unique hydraulic actuators are replacing out-moded methods of "precision control, manipulation and movement."

In brief, the versatile Bonnot **Hydromotor** develops instant, full torque in either direction—operates with oil, water or air—may



be installed anywhere, at any angle—is completely sealed and self-contained—may be stopped and reversed at any point.

Simple controls permit an infinite and variable range of speeds at any stroke length up to an arc of 280 degrees. Standard models develop 150 to 300,000 inch-pounds torque. Double vane units (same size) produce double torque—up to 600,000 inch-pounds—through 100 degree travel limit.

Larger and smaller sizes constantly under development or already custom-built.

Let us show YOU how Bonnot Hydromotors can help increase YOUR product efficiency or lower plant operating costs. Write for Bulletin 521 describing applications and engineering details . . . OR SUBMIT DETAILS OF YOUR SPECIFIC NEEDS.

For Lowering • Revolving • Lifting • Pushing
Pulling • Swinging • Opening • Closing • Clamping
Turning • Indexing • Oscillating, etc.

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SHUTTLE VALVES FOR SEQUENCING

unloading equipment. The machine is used to trim the edges of cold rolled flats for use as basic machine elements. The flats are stacked on the table and are clamped by eight hydraulic cylinders. As the work table completes its travel through the machine frame, two rotary cutters mill off the sides of the flats.

The first of two milling machines was installed in 1945 and was loaded and unloaded with a special hoist having four C-hooks. It was necessary for the operator to straighten and square the edges of the flats using a pinch bar and mallet.

A second milling machine installed in 1954 incorporates a hydraulic loading platform and hydraulic aligning cylinders. These improvements have produced several advantages. On the older machine, the overhead crane is required at the beginning and end of each machine cycle. Because the newer machine can be loaded and unloaded at any time in its cycle, the overhead crane is more available for other applications. An additional crane would have been more expensive than the loading equipment and would have been impractical because of the crowded area. Not only is operator fatigue reduced, but set-up time is shortened and the new equipment provides greater flexibility.

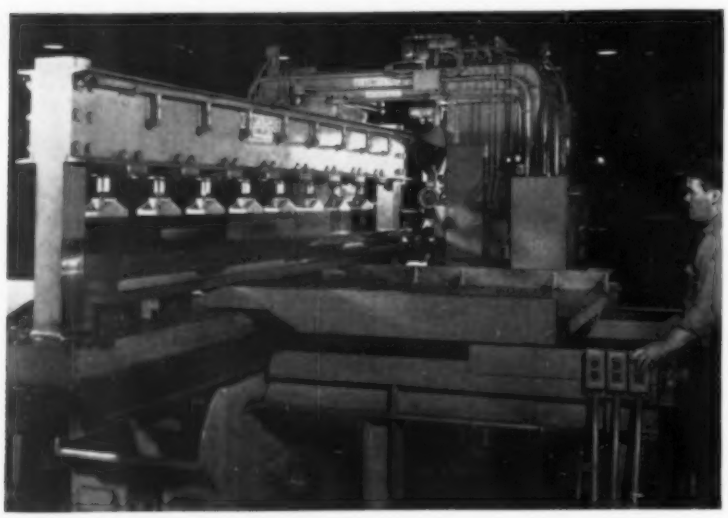
. . . put four hand controlled valves in front of the operator . . . this circuit shows how to prevent faulty action if the wrong valve is shifted.

The two loading platforms are operated by cylinders to raise and lower, and to move toward and away from the work table. The work is loaded on one of the fork type loading platforms which is then actuated to move forward and place the work on the mounting blocks of the work table.

ORIGINAL MACHINE requires special crane fixture for loading and unloading. Alignment must be done by hand using pinch bar and mallet.

ALIGNMENT AND CLAMPING

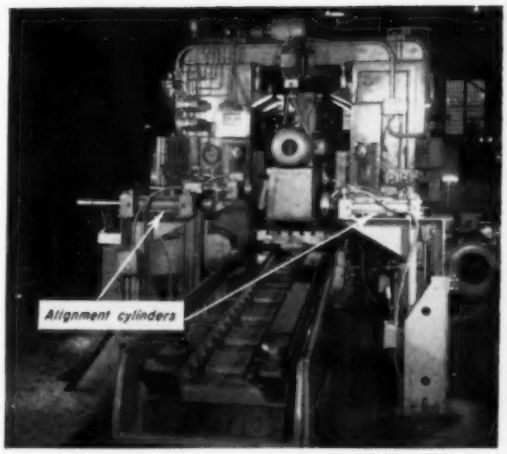
Two cylinders on each side of the work table align the work before clamping. The two cylinders on one side are double-end units. A clamping head is mounted on one end and a sleeve stop is mounted on the other end. This sleeve stop can be adjusted according to the width of material being worked, and provides a definite adjustable gaging point for the work.



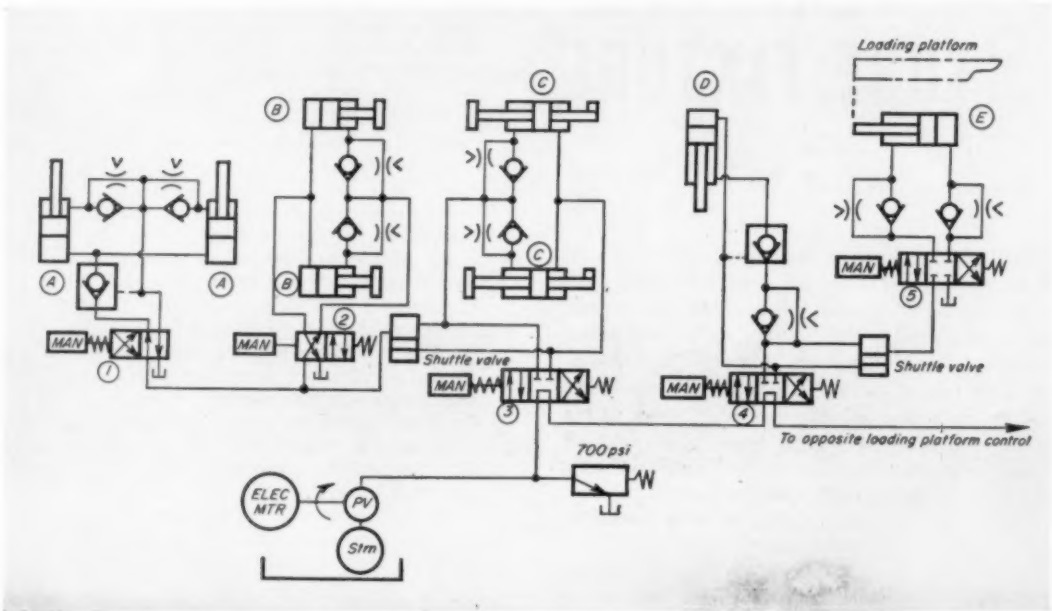
FORK TYPE TABLE moves up and down and perpendicular to the work table. Speeds of table movements are regulated by flow control valves.

The two aligning cylinders on the opposite side are moved up and down together by two other cylinders. This feature permits loading by the crane from that side. The double-end alignment cylinders on one side of the work table have a 3½-inch bore and a 1¾-inch rod diameter. The two alignment cylinders on the opposite side of the work table have a 2½-inch bore. Thus the double-end cylinders have an effective pressure area of 7.22 sq. in. and the single ended cylinders have a head end area of 4.9 sq. in. The resulting differential in clamping force produces resultant force against the sleeve stops of the double-ended cylinders and prevents movement of the work in the direction of either pair of cylinders during aligning.

The aligning and loading circuit operates at 700 psi and is powered by a 7½-hp motor driving a 10-gpm variable volume vane pump. The eight cylinders which clamp the work during machining are powered by a 12-gpm variable volume, pressure compensated vane pump mounted with its reservoir on the work table. This pump moves with the table. Power for the pump motor is connected through a cable reel mounted on the machine frame. ▼▼▼



FOUR ALIGNMENT CYLINDERS are mounted along work table. Cylinders to right can be lowered to provide clearance when loading work with overhead crane from that side. In retracted position, alignment cylinders actuate normally closed limit switches. This extinguishes red warning lamps to indicate cylinders are retracted and work table can be traversed.



BY CONNECTING VALVES IN SERIES and using shuttle valves, sequence safety of manually controlled operations is provided. Because valve 4, controlling loading platform, is connected in series with valve 3, controlling alignment cylinders, valve 3 must be centered for operation of platform. Loading platform cannot be operated at same time as alignment cylinders. Connecting controls of both loading platforms in series permits operation of only one platform at a time. Use of shuttle valves makes control of horizontal movement of loading platform dependent on control of vertical movement. Operation of alignment cylinders B and A is dependent on operation of alignment cylinders C. Loading platform cannot be moved horizontally unless valve 4 is operated to raise or lower platform. Aligning cylinders B and cylinders A cannot be moved unless valve 3 is operated to move cylinders C. Thus all operations are dependent upon valves 3 and 4 and valve for opposite loading platform corresponding to valve 4.

Pilot operated check valves in circuits to cylinders A and D act as counterbalance valves to hold the load up. Pressure must be applied to lower the cylinders before the check valves open to allow movement. Flow control valves control speed of the loading platform and alignment cylinders.

An end fitting that holds is the first requirement for a hydrostatic testing machine. Then comes the important matters of cost and simplicity of operation. Here's how a tool engineer designed a . . .

QUICK-CONNECT, LEAKPROOF TUBE FIXTURE

• By C. B. Weidner

SHOPS doing a large amount of high pressure piping find that a pre-use pressure test of component tubing is of great value in reducing rework due to tubing leaks. This pre-test, while a cost saver, is in itself a costly operation. The holding and sealing of the tubing for pressure testing requires either that the ends be soldered or held by some purely mechanical means such as a compression or flare fitting. The cost of ferrules or flaring plus later removal of the fitting nuts is no small item.

The problem can be reduced to basic functions:

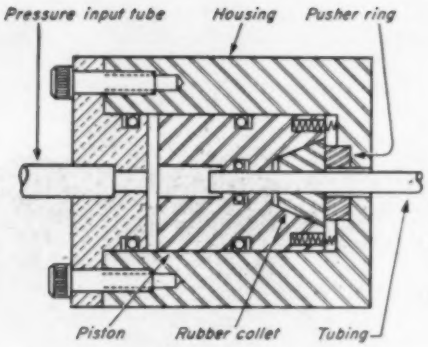
1. Sealing of the tube joint
2. Holding the tube ends to prevent the application of pressure from blowing them out of the fixture.

A good fixture, will accomplish both these functions and yet require only that the tube end be inserted into the fixture and simply withdrawn after pressure test. The drawing shows our answer to this tooling problem.

Let us suppose that we are receiving ¼ in O.D. tubing in 50 ft coils. The tubing is to be used in a 3000 psi system. Pressure test would be 4500 psi and because of attendant high pressure hazards the test will be performed hydrostatically.

The ends of the tubing coil are deburred on the O. D. The deburring tool also chamfers the tube. After deburring, the tube ends are pushed into the fixture. Fluid is allowed to flow through the tubing to evacuate the air. The drain valve is closed and pressure raised to the required value. After test pressure is removed, tubing ends are withdrawn from the fixture. ▼▼▼

C. B. WEIDNER, *Tool Engineer, Air Products, Incorporated, Allentown, Pa.*



Tube to be tested is inserted through the housing opening, through the pusher ring, through the collet and into the O-ring chamber in the piston. The collet is about 1/64 inch larger in I. D. than the tube O. D. A rubber collet will close in on an O. D. 1/8 inch smaller than its "free" position I. D. A collet of the type used in tap drives can be used and is inexpensive. When pressure is admitted to the fixture, the restriction to flow caused by the O-ring causes the piston to move to the right. The piston moves rather than the tube being forced out because its greater area exposed to pressure receives a greater total force. This large area also causes the piston to be sensitive to very low pressures. The piston moving to the right causes the collet to be pushed into the cavity in the piston by the pusher ring. This collet motion causes it to close tightly on the tube. As the pressure in the fixture rises, the collet grips more tightly. For extreme pressure applications it is well to limit amount of collet closure by adjusting the length of the pusher ring so that the piston can bottom on the entry wall of the body. When the pressure is relieved, the springs cause the piston to move to the left. This motion causes the collet to release the tube and allow its easy withdrawal from the fixture. The springs are only of sufficient strength to override the frictional resistance of the O-ring. Pressure input tube is silver brazed in the end flange which is provided with an O-ring to effect a seal with the body.

All O-rings are backed up with anti-extrusion rings for high pressure service. Making all parts from stainless steel allows water to be used for the hydrostatic fluid.

What's New in VICKERS HYDRAULICS

Illustrated here are new and recently improved units added to Vickers most complete line of oil hydraulic equipment. Look to Vickers as a single responsible source for integrated hydraulic systems. For characteristics of any of these components, please write for Installation Drawings by number.

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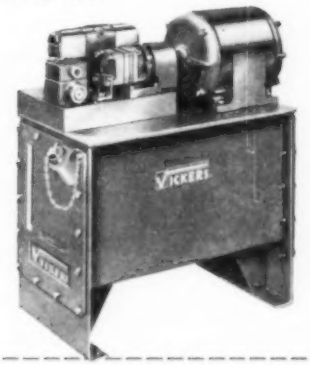
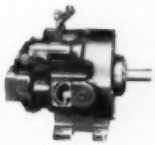


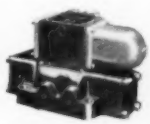
V-LINE PISTON PUMPS AND MOTORS for 5000 psi. Unique design minimizes relative movement between rotating parts, provides increased bearing surfaces and reduces complexity of parts. Result is improved efficiency, longer life, and reduced maintenance. Supplied with straight thread connections. Bulletin 55-72.



Variable Displacement Pump With Servo Control. Inst. Dwg. 179061. Also available with pressure compensator control. Inst. Dwg. 179060.

Constant Displacement Fluid Motor. Inst. Dwg. 179059. Available also is a Constant Displacement Piston Pump. Inst. Dwg. 179058.

DG4S4 ⅜" solenoid operated. Inst. Dwg. 182412. ¼" available later.



DG5S4 ¾" solenoid controlled pilot operated. Inst. Dwg. 182413. 1¼", 2", 3" available later.

SOLENOID OPERATED 2- AND 4-WAY VALVES with many improved features. (1) Integral junction box (2) covers that retain the solenoids and (3) manual operation for testing. Compact and versatile. Gasket mounting simplifies installation and overhaul . . . also minimizes piping.

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CPP-2242 Solenoid Controlled. Pilot Operated (gasket mounted) provides smooth, low current operation. Inst. Dwg. 182414.

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CO2 Reciprocating Cycle Control Panel For Gasket Mounting. Inst. Dwg. 177083.

4CG-03 Pilot Operated Check Valve, gasket mounted. Inst. Dwg. 135468.

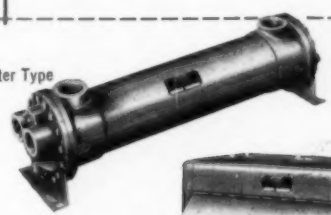
CG-714 Deceleration Valve, gasket mounted. Inst. Dwg. 172902.

CGV-06 5000 psi Relief Valve gasket mounted with straight thread connections. Inst. Dwg. 177609.

URG1 Unloading Relief Valve, gasket mounted. Inst. Dwg. 178974.

SG1 Pressure Switch, gasket mounted. Inst. Dwg. 172538.

Water Type



OIL COOLERS Vickers Oil Coolers are characterized by their very high rate of heat transfer per unit of space occupied. Bulletin 55-69.

Air Type

For further information on any unit shown, ask for Installation Drawing by number indicated. 7435

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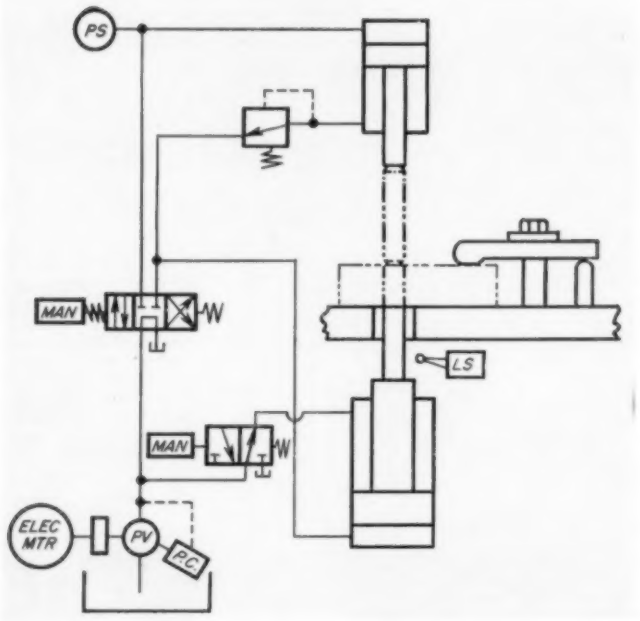
ENGINEERS AND BUILDERS OF OIL HYDRAULIC EQUIPMENT SINCE 1921



Here is "smart" circuitry which senses fits that are too loose or too tight. The hydraulics also has the power to push out a part that's too tight.

PRESS-FIT TOOLING

. . . throws out bad parts

ASSEMBLY tooling shown in the hydraulic circuit is all manually operated except for the electric signalling devices which operate indicator lights. The tool engineer can readily adapt this circuit idea to a variety of assembly jobs.

A 4-way three position valve controls the motion of the upper piston which pushes the loose workpiece into the rigidly clamped member. A counterbalance valve shown in the circuit can be used if it is found necessary to maintain a small back pressure to hold the piston up when the press is not in use. Use of this valve would depend on weight of the upper piston, and amount of leakage through the closed center 4-way valve.

The pump may be a variable volume pressure controlled pump as shown, or a hi-lo double pump. Either selection would be efficient. However, if the press stroke is short and if operation is not continuous, a fixed displacement pump could be selected. Maximum pressure is set to produce the maximum force required for greatest interference between the parts.

The lower cylinder is used to check the fit for tightness and to eject a part which has not driven completely home because of too much interference. To perform these two functions, its size in relation to the upper cylinder must be properly proportioned. To check for tightness, a force of about ½ the pressing force is used. To eject the part, a force equal to twice the pressing force should be available.

The ejector cylinder is controlled by the 4-way and a 3-way valve. The fit is automatically tested when the 4-way valve is moved to raise the upper piston. At this time, oil pressure will be acting on both the rod and blank ends of the ejection cylinder. The resultant force on the blank end is the test force. If the fit is not tight enough, the pin will be pushed out. As the loose pin is ejected, the limit switch is tripped to light a warning lamp. If the fit is too tight, the part probably will be only part way in, making disassembly necessary. The pressure switch will trip to light a warning lamp when excessive pressure develops.

The operator will then shift the 4-way to raise the upper piston and then shift the 3-way which opens the rod end of the ejection cylinder to tank so that full ejection force can be developed on the blank end.

In our setup, the upper piston has a 2 inch bore. When pressure is set at 1000 psi, the force on the head end is about 3,200 pounds. We get about 7000 pounds for ejection with a 3 inch bore for the lower cylinder. The test pressure depends on the rod size of the ejection cylinder. A 1½ inch rod does the job by giving a test force of 1800 psi. ▼▼▼

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Ask a user what part of a cylinder determines the amount of down-time for repair and his answer is almost sure to be: "the packings". Because packings are the most vulnerable part, it's important to understand where they are used, what types are available, and how to install them properly and rapidly. Here are some pointers which will help the user of non-metallic . . .

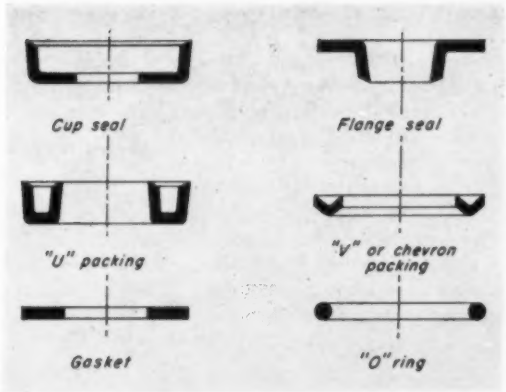


FIG. 1. PACKINGS for hydraulic and pneumatic equipment are available in a variety of shapes to meet the requirements of piston rod, piston head and static joint seals.

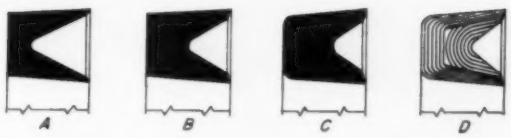
PACKINGS . . . *for air and oil cylinders*

• By E. P. Stahl

BOTH static and dynamic seals are used in fluid power cylinders to prevent leakage and to permit efficient build up of hydraulic force. The static seals used at joints are in most cases O-ring type or flat gasket material. These static seals have very long life and are seldom a source of trouble. It is the moving seals which fail and require service. When the cylinder is disassembled for service, examination of static seals and proper assembly which avoids damage to the seals will prevent trouble.

Moving or dynamic packings are used as seals between the reciprocating piston head and the cylinder wall, and between the piston rod and cylinder end cap. Packings used at these points are automatic in action because pressure promotes sealing. Figure 1 illustrates common shapes of non-metallic packings. Sealing action of the cup, "U", Vee and O-ring increases with pressure.

In general, it is much easier to design a hydraulic packing to withstand medium and high pressures than one to seal very low pressures. Frequently, hydraulic packings which are required to withstand appreciable working pressures, must also be effective in preventing oil leakage when the mechanism is not in use or not under pressure. A finger spring or garter spring may be used for preloading the sealing lips when they are not actuated by fluid pressure. For low pressures, up to 200 psi, the lips of hydraulic packings should be comparatively long and flexible as shown in Figure 2 design A. For medium pressure, 200 to 1500 psi, a stouter lip and heavier cross section as shown in Figure 2 design B are desirable. For high pressures a stiffening of



(A) For low pressure up to 200psi
(B) For medium pressure 200 to 1500psi
(C&D) For high pressure 1500psi & up

FIG. 2. EFFECT of pressure on the form of the lip for synthetic rubber "U" packings.

E. P. STAHL, *The Garlock Packing Co., Palmyra, New York.*

the section and shortening of the lips as shown in Figure 2 designs C and D are desired. Design D is a cloth-inserted or fabric seal with a heavy cross-section.

At high pressures it is increasingly important to reduce piston clearance to absolute minimum in view of the danger of heel extrusion. Fabric or cloth-inserted cup and flange packings are often recommended for high pressures because of their resistance to wear and extrusion.

MATERIALS

Automatic, "U", flange and cup, packing made of oak-tanned and chrome-tanned leather have proved highly satisfactory for water pressures for many years. Chrome-tanned leathers are used with oil but oak-tanned leathers are not suitable because mineral oil tends to dissolve the natural fats in leather to make it brittle. This is particularly true if the oil gets hot.

The ideal sectional shape of a hydraulic packing depends not only on the pressure and other operating conditions but also on the packing material used. Packings made from soft materials, as a general rule, behave under low pressures as hard or tougher materials behave under higher pressures. The "U" packing cross-sections shown in Figure 2 for various pressures is based on a hard grade of synthetic rubber material of 90 deg Shore hardness. The higher the pressure, the less important become the sealing lips of "U" packings.

For many years, packing manufacturers have used rubber in various forms and shapes as sealing devices. Prior to development of synthetic rubber, such packings had limited applications. Today, many available oil resistant elastomers are widely used for pneumatic and hydraulic cylinders.

The term "synthetic rubber" covers materials having widely varying properties such as hardness, resilience, cold flow, aging, etc. These properties vary with temperature, pressure and nature of liquid being sealed.

Pre-aging of synthetic rubber packings in hydraulic fluids gives much more consistent results than packings that are not aged or those that have been subjected to a variable amount of air aging. It is suggested that packings be soaked in hydraulic oil, wrapped and packaged with appropriate identification.

In the last few years, Teflon has been finding greater use as a packing material for hydraulic cylinders. It is impervious to petroleum base and fire resistant fluids, and will withstand temperatures from −100 to 500 F.

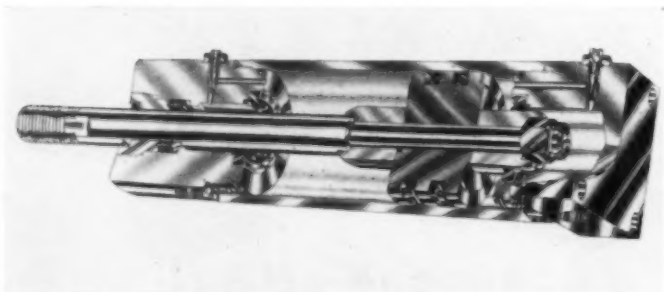


FIG. 3. AIR CYLINDER design uses "U" cup packings on the piston head, Vee packings are used on the rod end. Tomkins-Johnson Co.

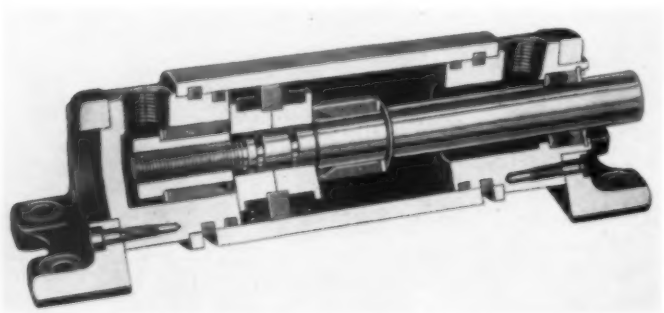


FIG. 4. HYDRAULIC CYLINDER uses Vee type rod packing of Buna-N compound. The piston packings are a single lip design made from a neoprene and duck compound. Ortman-Miller Machine Company.

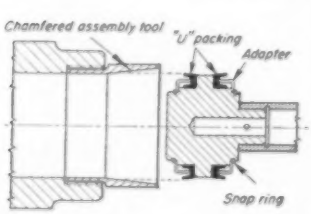


FIG. 5. DAMAGE which might be caused by passing the packings through threads is avoided by use of the chamfered assembly tool.

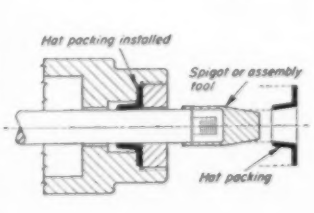


FIG. 6. FLANGE packing assembly over a sharp edge is facilitated by use of the spigot type tool.

INSTALLATION SUGGESTIONS

Care must be taken in installing hydraulic packings because most of these packings have interference at the sealing lips. The outer sealing lip is larger than the bore of the cylinder into which it

fits and the shaft packing is smaller than the rod on which it fits. Very often packings have to be pushed past threads, or over splined shafts. It is often necessary to use assembly sleeves or spigots as shown in Figure 5. Figure 6 shows a method of assembling a packing over the end of a shaft in a hydraulic jack.

WHAT CAUSES PACKING FAILURE

Abrasive wear is caused by roughness or poor finish of metal parts, scores, blow holes, grit, etc. Whenever possible parts on which packings operate should be hardened, ground and polished. Chrome plating also helps in some cases. Grit should be filtered out of the hydraulic fluid.

Heel extrusion, which is the forcing of packing material between piston and cylinder or piston rod and gland housing followed by tearing of trapped packing material, is due to excessive piston clearance or unsuitable material.

Blow out of cup or flange packing may be caused by inadequate compression of packing flanges; use of too elastic material to withstand pressure encountered, and softening of material caused by heat or swelling action of fluid. Possibly fabric or cloth inserted packing will remedy the trouble. The compression should be limited by provision of shoulders, or spacing of collars.

Hardening can be the cause of the wrong material or of heat which reduces piston clearance. Softening too may be caused by the wrong material, heat, or absorption of fluid by the packing material. ▼▼▼

Editor's note: Other articles, recently published in APPLIED HYDRAULICS, which will give you information about design and application of packings are: *Increased O-Ring Life*, Gil Close, Feb. 1956; *Piston Rings for Hydraulics*, E. J. Taschenberg, J. W. Pennington, Nov 1955; *Packing Gland Redesign Reduces Pump Maintenance*, R. W. Cline, Oct. 1955; *O-Ring Maintenance*, R. G. Dempsey, Oct. 1955.

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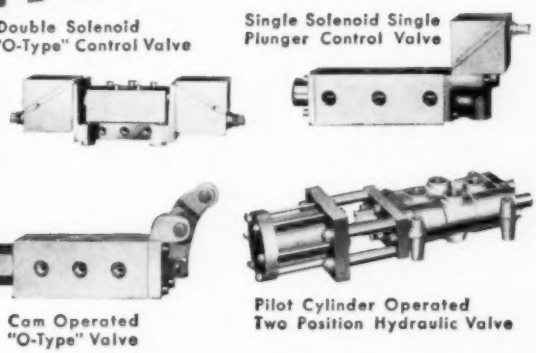
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Pilot Cylinder Operated Two Position Hydraulic Valve

efficient and dependable operation of your machines and machinery

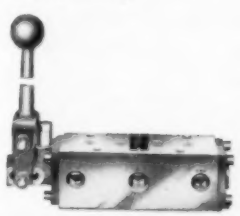
Can you afford to gamble with less?

• Why build — or buy — expensive machines and then restrict their output and risk breakdowns and production tie-ups because of inferior control valves?

Positive and fast acting Quick-As-Wink valves meet the most exacting requirements. They deliver dependable precision performance month after month and year after year. Machine operators, foremen, superintendents *and machine builder trouble shooters* will tell you that there is nothing better than a Quick-As-Wink valve. REMEMBER,— your efforts to increase production and cut costs can only be as successful as the air and hydraulic valves that control the operations. Don't gamble. Play safe. Specify Quick-As-Wink valves. Get full details. Write for Bulletin No. 531, *Today!*

Ask us also about . . .

FOOT OPERATED SLIDING SLEEVE VALVE ⅝" to 1" sizes. Single pedal spring return and two pedal designs. Operator has both hands free to handle the work.



LEVER OPERATED SINGLE PLUNGER VALVE ⅜" to 1½" sizes. Widely used for controlling single and double acting cylinders and as pilots for other valves.

Quick-As-Wink® AIR AND HYDRAULIC Control Valves

THE HIGHER THE PRESSURE THE TIGHTER THE SEAL

Hand, Foot, Cam, Pilot, Diaphragm and Solenoid Operated

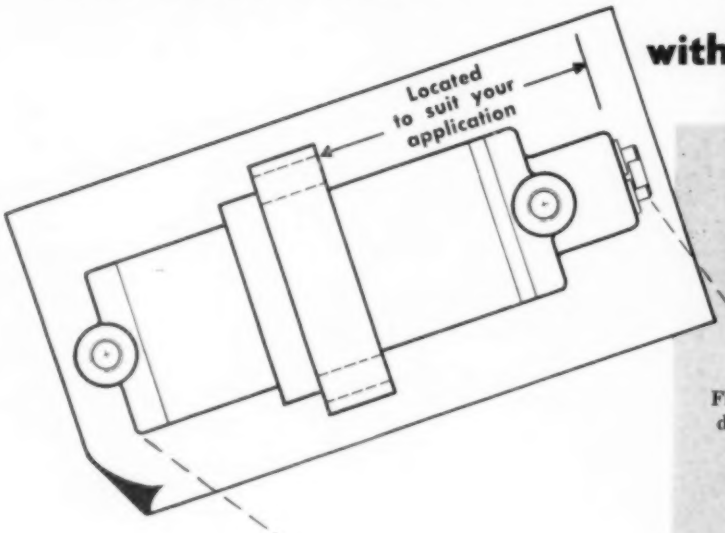
Mfd. by C. B. HUNT & SON, INC., 1999 East Pershing St., Salem, Ohio

Circle 68 on Reader Service Card

"We Saved 25% of the Cost of Base Castings"

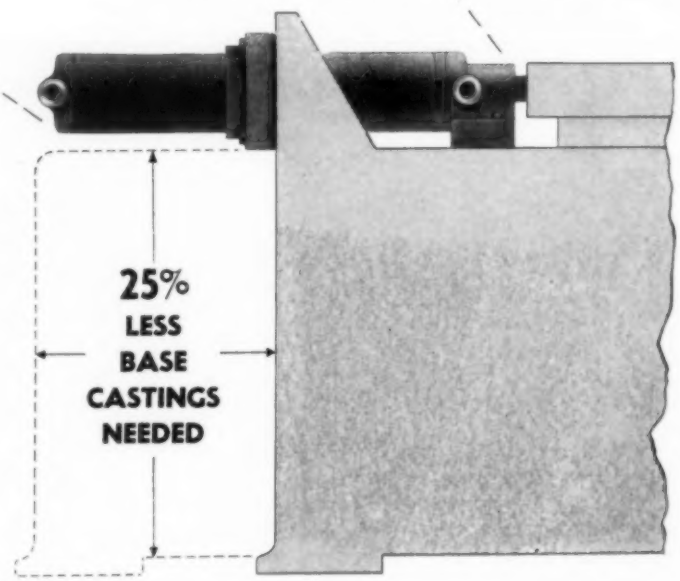
with

Pathon INTERMEDIATE FLANGE MOUNTING HYDRAULIC CYLINDERS



Application of the Pathon Intermediate Flange Mounting, as shown by the simplified drawing below, saved this machine company 25% of their base casting cost. Bonus advantages included reduced shipping weight, easier handling, and the universally recognized operating efficiency inherent in all Pathon Cylinders.

With Pathon Intermediate Flange Mounting Cylinders you choose whichever mounting position best suits your specific needs. Various heads of other mounting types may be combined with the intermediate flange to provide a large number of combination mountings. Thus special mounting brackets are eliminated. The cylinder is rotatable to any position for connecting pipe ports and mounting puds. Pathon Cylinders are available in the R. H. 2000 P.S.I. Series and the Q.H. 1000 P.S.I. Series.



HAVE YOU A HYDRAULIC CYLINDER MOUNTING PROBLEM?

The chances are that one of the standard eight Pathon Hydraulic Cylinder mounting types or their combinations will adequately fill it. However, on any unusual Cylinder problem, we will be glad to help you reach a solution. Don't hesitate to write us.

Pathon MANUFACTURING CO.

3823 PACIFIC AVE. — CINCINNATI 12, OHIO

AIR CYLINDERS—HYDRAULIC DIRECTIONAL CONTROL VALVES—HYDRAULIC CYLINDERS

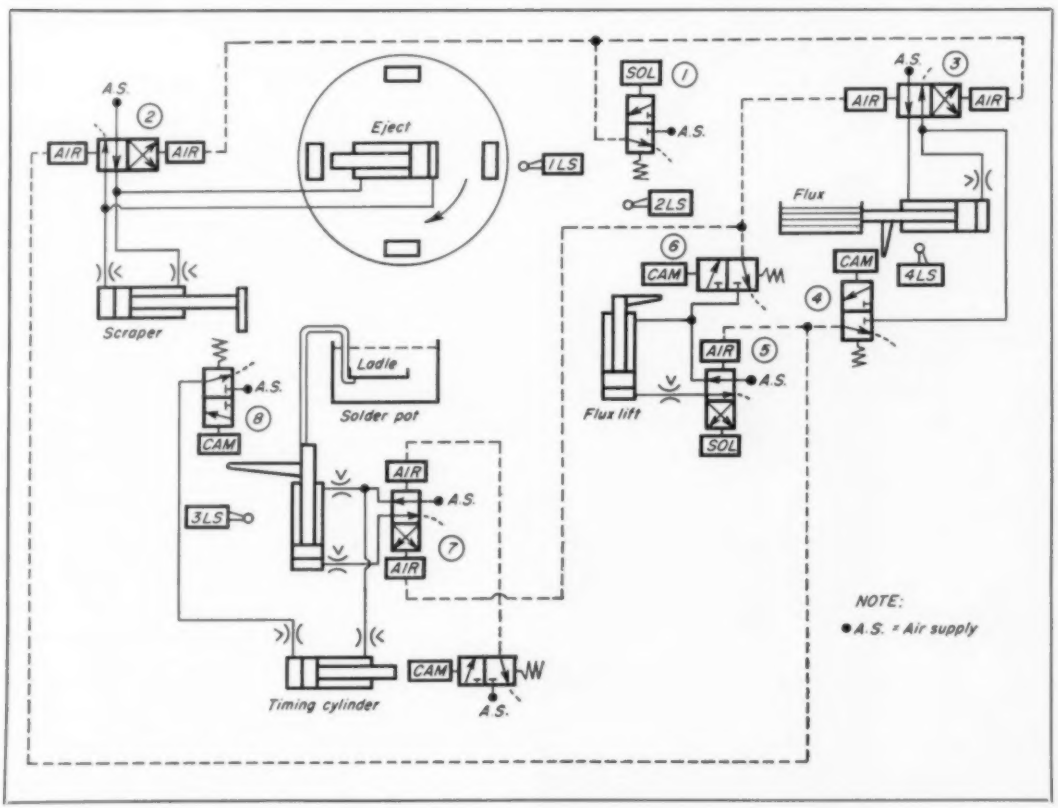
Circle 111 on Reader Service Card

Tool designers, assigned to develop automatic soldering fixtures for small parts, will be tackling a challenging job. Did you ever study the motions made when hand soldering a few connections on—let's say a small capacitor used in the ballast of a fluorescent fixture? To convert the many necessary motions to automatic operation takes considerable ingenuity.

TOOLING IDEAS

AUTOMATIC SOLDERING CIRCUIT

. . . reduces handling and costs



● By George Kartman

WHEN you're doing a million soldering operations a year to produce small capacitors, time spent in the development of good tooling pays off in dollars saved. The drawing shows the pneumatic circuitry devised to automatically solder the leads and resistors to small capacitors. After the work is inserted in holders mounted on a standard air operated, electrically controlled indexing table, the operator starts the cycle to automatically flux, solder and eject the work while the next unit is being prepared. If this cycle is finished before the next unit is ready for soldering, the machine has a

New Products By

L and L

Only L & L offers the complete line of fittings, with the widest choice of design, for any type of hydraulic piping application.

CN Fittings

- L & L "CN" seals pressure *without* use of O-Ring.
- Savings in tools, scrap and loss of production, also in assembly and maintenance.
- Eliminates stress in valves—elbows and tees can be positioned to 405°.
- Assemble and reassemble without damage to port or fitting—no need for sealing compounds.
- Excellent resistance to vibration.

L & L O-Ring Fitting

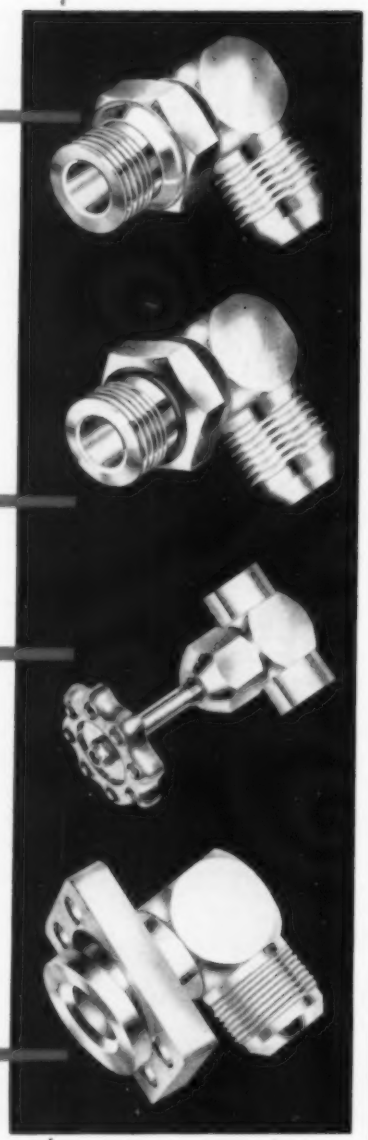
- Seals pressure *with* O-Ring.
- Reduces installation time—no need for sealing compounds.
- Range of sizes from ⅛" to 2".

Metering Valves
Carbon or Stainless Steel

- Pressures up to 5000 PSI.
- Straight or angle valves with male pipe, female pipe or tube connections.
- Use as a metering or shut-off valve.
- Range of sizes from ⅛" to ¾".

Flange Fittings

- S.A.E. bolt hole spacing.
- Solid and swivel tube, pipe or weld connections.
- O-Ring seal.
- Elbows and tees can be positioned.
- Bolt together and use as flange unions.



Representatives in principal cities. Write for full particulars to:

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Only L & L gives you a "Complete Fitting Line"

AUTOMATIC SOLDERING FIXTURE

Continued

built-in safety to prevent recycling.

Here's how the circuit works. The operator presses a control button to index the table 90 degrees. Just before the indexing is finished, limit switch 1 will be actuated momentarily, giving an impulse to solenoid valve (1) which will open for the air to shift control valves (2) and (3). Control valve (2) supplies air for the ejector which at this moment ejects the previously soldered unit. At the same time, air pressure powers the scraper to slowly skim the solder pot. Control valve (3) will supply air pressure to bring the flux basin slowly forward. Before the flux basin reaches its position, under the terminals to be soldered, it actuates valve (4) momentarily, to direct pilot air pressure to reverse control valves (2)and (5). When valve (2) is reversed, the ejector is withdrawn and the scraper passes once more over the surface of the solder to leave it perfectly clean. Air is directed by valve (5) to the bottom of the flux lift cylinder.

. . . safety, controlled timing and automatic cycling . . . these factors are assured by careful selection and arrangement of pilot, cam, and solenoid operated air valves.

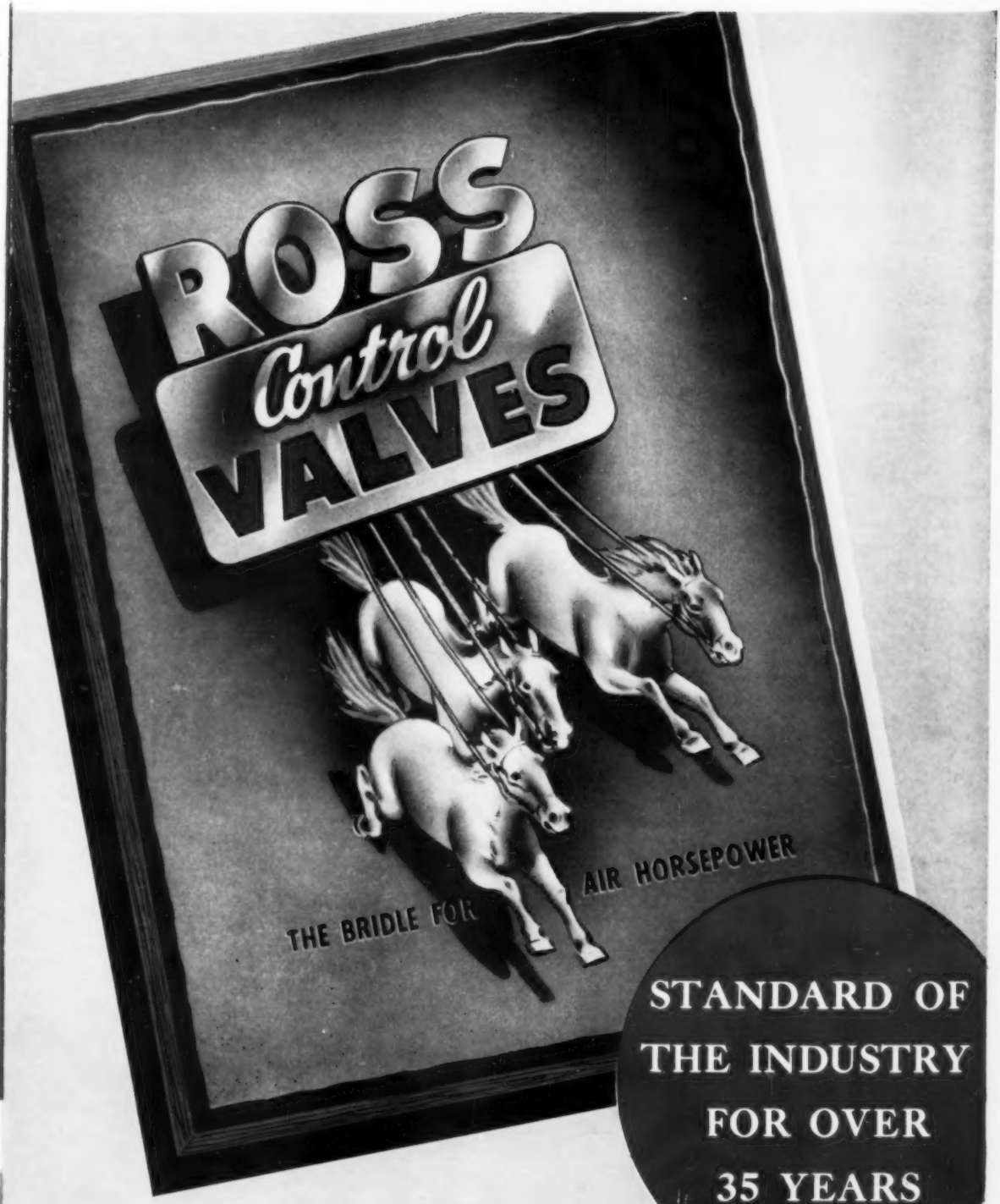
Reaching its top position, the flux basin will trip limit switch (2) to cause reversal of valve (5). The limit switch was used here instead of an air valve due to lack of space. As soon as valve (5) is reversed, the flux lifter cylinder goes down. On the down stroke, valve (6) is actuated to direct air to shift valves (3) and (7). The flux basin is returned and air pressure acts to raise the ladle submerged in the solder pot.

TIMED BY A PISTON STROKE

Reaching its top position, the solder ladle trips valve (8) to allow air to go through the adjustable bleeder to the timer cylinder. This cylinder controls the time the terminals are submerged in the solder. When the timer cylinder completes its stroke, it compresses valve (9) to cause reversal of valve (7) which directs air to slowly lower the ladle into the solder pot. The machine is now ready for recycling.

The two normally open limit switches, 3LS and 4LS, are connected in series with the operator's control button for recycling. These switches will only permit starting a new cycle if the flux basin is in its back position and the ladle is resting in the solder pot. ▼▼▼

GEORGE KARTMAN, *Engineer, Specialty Transformer Div. Canadian General Electric, Toronto.*



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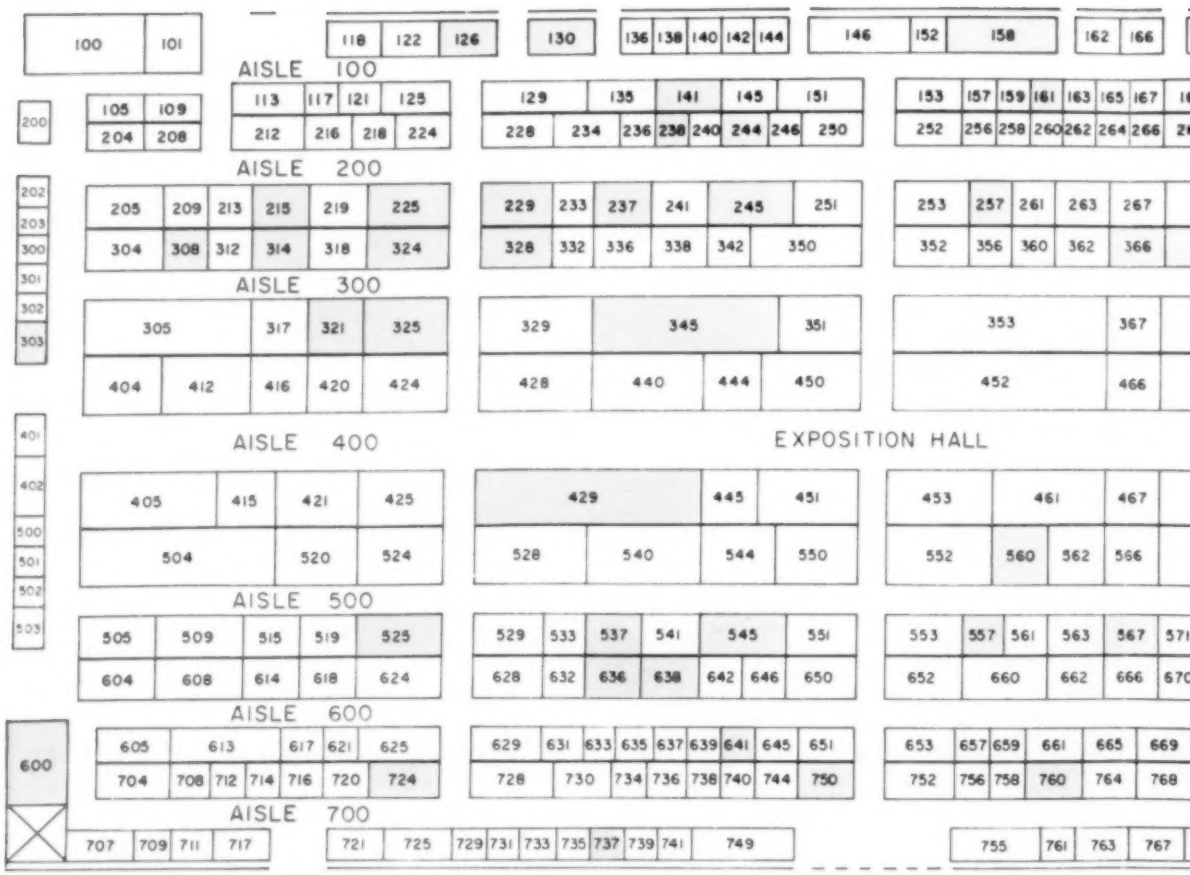

161 Raybestos Manhattan

158 Hannifin Corporation

14[illegible] C. B. Hunt & Son

130 Valvair Corporation

126 Rogers Hydraulics, Inc.

215 Mead Specialties Company

225 Tomkins-Johnson Co.

229 Racine Hydraulics & Machinery Inc.

237 Modernair Corporation

238 National Fluid Power Association

244 National Pneumatic Co., Inc. and Holtzer-Cabot Divs.

245 Logansport Machine Co.

257 S-P

279 Soc

374 Bro

366 Ha

345 Ing

328 Ga

324 Riv

xhibitors of Fluid Power Pro

INDUSTRIAL EXPO

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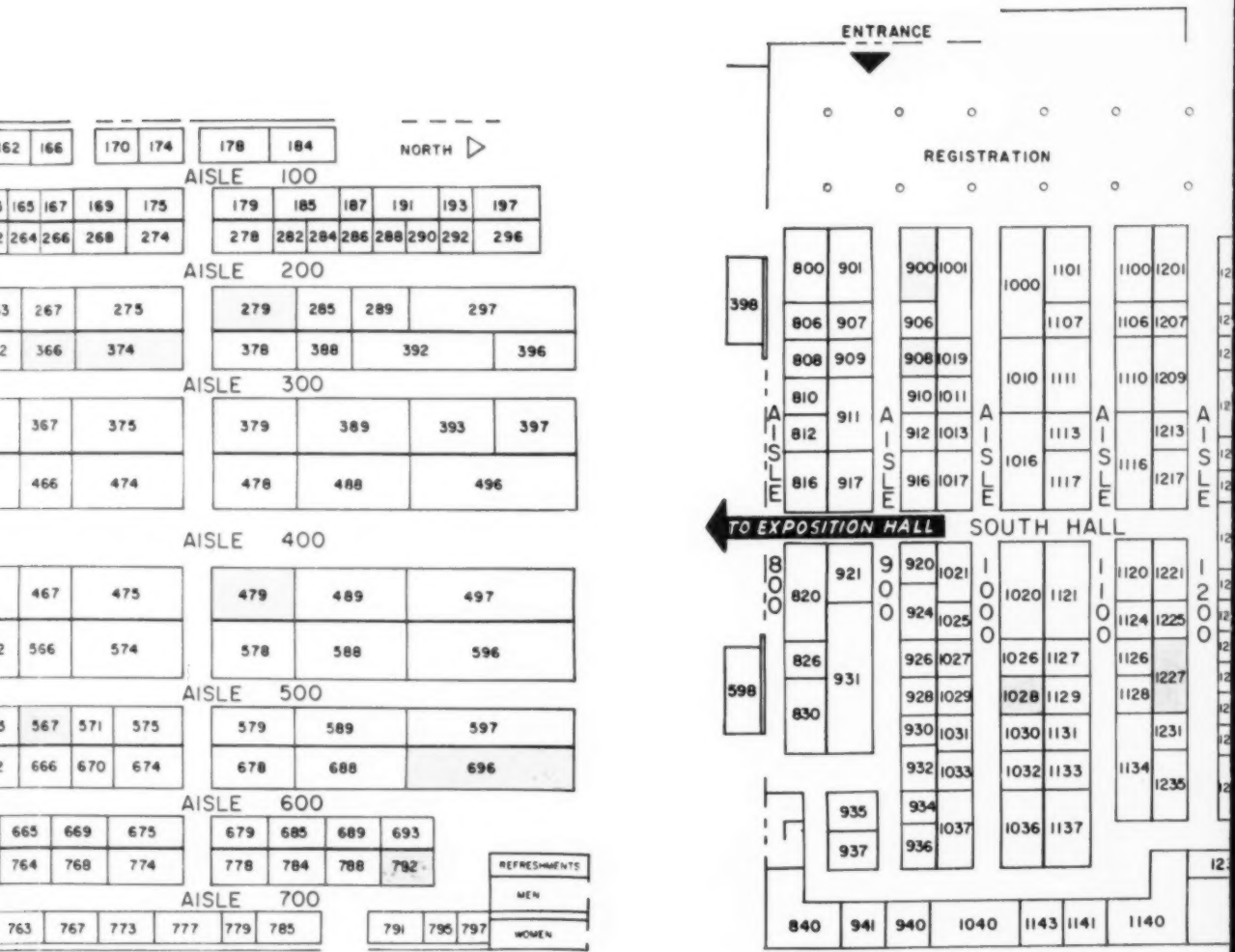

257 S-P Manufacturing Co.
279 Socony Mobil Oil Co.
374 Brown & Sharpe Mfg. Co.
366 Hanna Engineering Co.
345 Ingersoll-Rand Co.
328 Galland-Henning Mfg. Co.
324 Rivett Lathe & Grinder, Inc.

325 C. A. Norgren Co.
321 Hydro-Line Mfg. Co.
314 Ortman-Miller Machine Co.
308 A. W. Cash Co.
303 Alpha Molykote Corp.
429 Miller Fluid Power Co.
479 Standard Pressed Steel Co.
567 Industrial Filtration Co.

560 Garlock Packing
557 M-B Products C
545 Beckett-Harcum
537 Bendix-Westingh
525 A. Schrader's S
636 Carter Controls
638 Aro Equipment
641 Applied Hydrau

ducts

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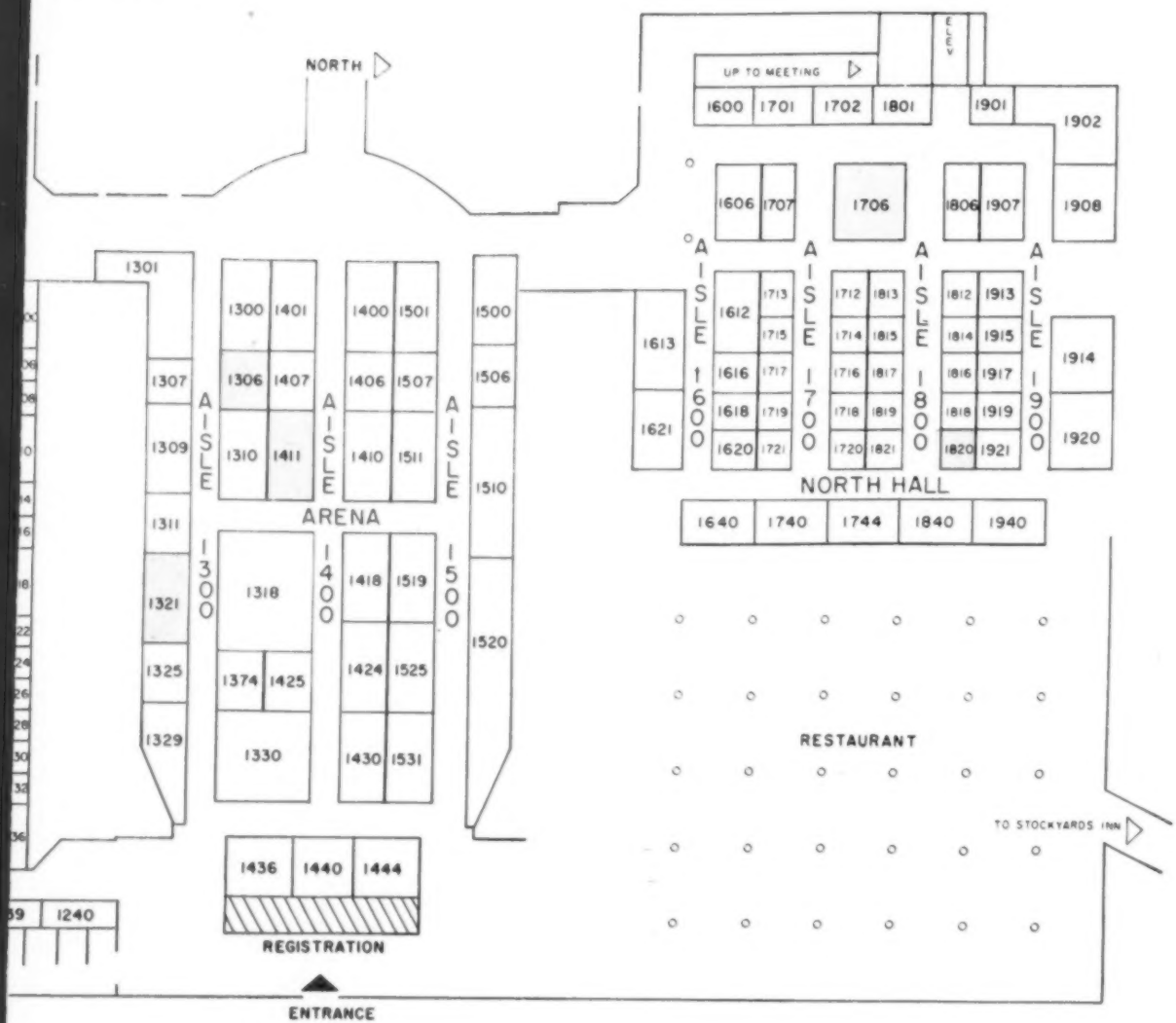
THE MAGAZINE OF FLUID POWER



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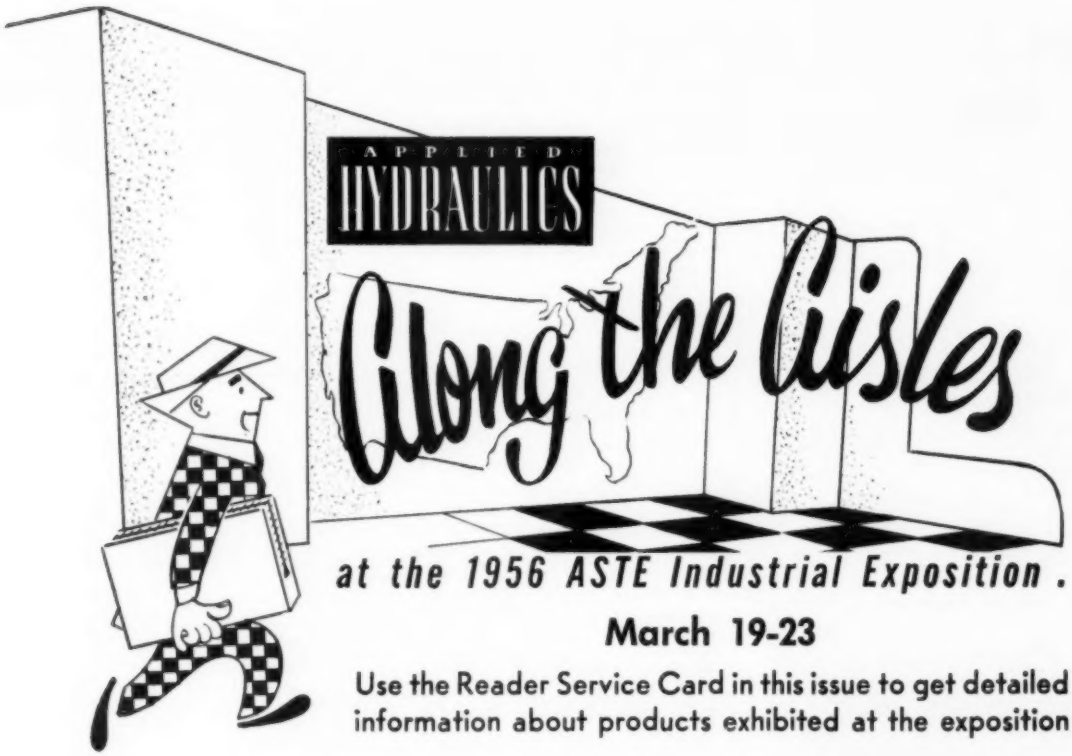
696 Ross Operating Valve
792 U. S. Rubber Co.
760 True-Trace Sales
750 Gerotor May Corp.
737 Drillmation Co.
724 Roto-Mation Inc.
600 Schramm Inc.
900 Logan Engineering

908 Allied Witan Co.
1028 Marvel Engineering Co.
1227 Crane Packing Co.
1321 Chicago Pneumatic Tool
1306 Shell Oil Company
1411 Vickers, Inc.
1706 Denison Engineering Co.
1820 Davey Compressor



at the 1956 ASTE Industrial Exposition . . .

March 19-23

Use the Reader Service Card in this issue to get detailed information about products exhibited at the exposition

Booth

908 Allied Witan Company

You'll see . . . the new series 4-44 noise attenuator for air systems. This new unit has an internal resonator and a diffuser with a large exhaust radiation area. Available in eight pipe sizes from ⅛ to 2 inch NPT.
You'll meet: S. J. Gibel, Ed Anderson, W. E. Hennell.

Circle 301 on Reader Service Card

374 Brown & Sharpe Mfg. Co.

You'll see . . . an exhibit including gear pumps built in sizes to deliver approximately 1 to 50 gpm at 500 psi.

Circle 302 on Reader Service Card

560 The Garlock Packing Company

You'll see . . . a line of mechanical packings and sealing devices for air and hydraulic applications. Packings made from Teflon, Kel F and Silicones will be prominently displayed.
You'll meet: J. B. Sewell, v.p., H. J. Ramshaw, district mgr., Ford Wilders, sales, E. W. Fisher, service, J. R. Smith, mkr. mechanical seal dept.

Circle 303 on Reader Service Card

545 Beckett-Harcum Company

You'll see . . . their complete line of air and hydraulic valves. The exhibit will feature a new series of valves for handling slurries and other viscous fluids.

Circle 304 on Reader Service Card

303 The Alpha Corporation

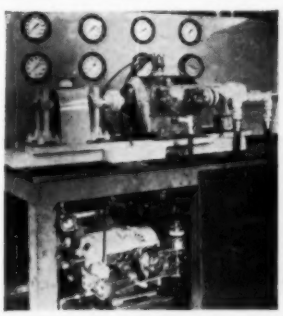
You'll see . . . Molykote lubricants, which are being used in various industries, to solve high temperature and high pressure lubrication problems.
You'll meet: David Noltie, Alpha's vice-president and Harold Braner.

Circle 305 on Reader Service Card

641 Applied Hydraulics Magazine

You'll see . . . pictorial display of fluid power applications for better tooling. Sample copies of the recently published Master Catalog of Fluid Power Products and "Air and Oil Cylinders in Industrial Applications" by Elmer Heiser.
You'll meet: General manager Ben Horchler and AH's editors Paul Reed, Paul Rolnick and Allan Morris.

750 Gerotor May Corporation



You'll see . . . a display of hydraulic pumps and motors. Featured product is the new variable speed transmission. Having an output speed range of 425 to 1500 rpm at a maximum hp of 3.5; and an output speed range of 60 to 425 rpm at a maximum torque of 525 in-lbs.
You'll meet: Earl L. Wilson, C. Nat Eckhardt, Jr., C. R. Rodgers and Elmer Boehs.

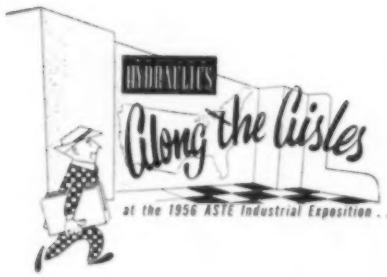
Circle 306 on Reader Service Card

557 M-B Products Division

You'll see . . . a demonstration of their line of air tools protected by their line of air filter—regulator—lubricator units.
You'll meet: Irving N. Manheimer, president, and a number of M-B's distributors.

Circle 307 on Reader Service Card

← This fold-out insert is your guide to Fluid Power Exhibits



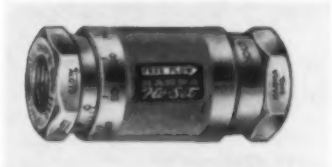
Booth

328 NOPAK Division Galland-Henning Mfg., Co.

You'll see . . . complete line of valves and cylinders, both air and hydraulic. There will be a number of working models. Featured product is the new line of square head cylinders for oil hydraulic service to 1000 psi.

Circle 308 on Reader Service Card

366 Hanna Engineering Works



You'll see . . . featured the FLO-SET line of speed control valves. These valves are used for controlling speeds of air and hydraulic cylinders. Rated for 250 psi air or oil service, the light weight valve is made from aluminum and stainless steel. Universal mounting brackets and universal trunnion will be featured accessories for T750 series fluid power cylinders which will also be displayed.

You'll meet: J. T. Ellis, J. C. Hanna, H. C. Hallerstrom, A. F. Jensen, W. B. Kuhnke, D. L. Shanks, and E. R. Vogeney.

Circle 309 on Reader Service Card

141 C. B. Hunt & Son, Inc.

You'll see . . . an entirely new line of valves which is known as the "B" type. Initially available in the ½" sizes in single or double solenoid and in various other actions, such as hand, pilot cylinder operated, etc.

You'll meet: N. A. Pedersen, S. C. Chessman, Kenneth Meyer, and Henry Zimmerman.

Circle 310 on Reader Service Card

238 National Fluid Power Association

You'll see . . . a new brochure, prepared for the general public, which describes part played by fluid powered equipment in industry, agriculture and aviation.

You'll meet: Executive secretary, Barret Rogers.

792 United States Rubber Company

You'll see . . . a display of the U. S. PowerGrip "Timing" belt drive. This belt provides precision control of speed ratio between shafts. Teeth of the belt engage grooves of pulleys to produce a positive, non-slip drive with a minimum of backlash.

You'll meet: J. F. Comstock, H. E. Dadson, J. H. Stevenson, H. W. Weihenmayer.

Circle 311 on Reader Service Card

257 The S-P Mfg. Corp.

You'll see . . . a new line of air cylinders of square end design available in eleven bore sizes from 1½ through 14 inch. Also featured will be a new rotating hydraulic cylinder that provides greater force in a smaller area than is possible with an air cylinder.

You'll meet: D. Lee Bassett, Dave Davenport, Harry Adams, Merritt B. Sampson.

Circle 312 on Reader Service Card

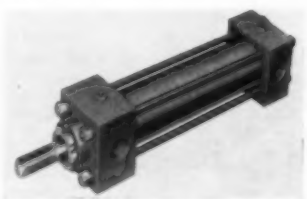
479 Standard Pressed Steel Co.

You'll see . . . display of fasteners including dryseal thread hydraulic pressure plugs.

You'll meet: Daniel F. Hulgrave, Jr., John Turner, Donald C. Beucker, L. John Klenk, George A. Gage, v.p. in charge of sales, A. W. Scott, advertising manager.

Circle 313 on Reader Service Card

245 Logansport Machine Co., Inc.



You'll see . . . complete line of air and hydraulic valves, cylinders, power packages and filter units. Featured product will be the new Ultra-matic cylinder and the new line of pilot operated solenoid control valves. An attention getter will be Mr. Logan-mation who will be fluid power operated.

You'll meet: Charles H. Wilkinsen, president; v.p's L. L. Austin, and Howard J. Peppercorn; sales manager, L. R. Burger; H. L. Stewart and Joe Moritz.

Circle 314 on Reader Service Card

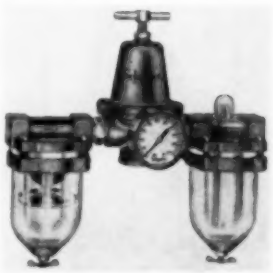
1411 Vickers Incorporated

You'll see . . . a complete line of oil hydraulic components: pumps, motors, valves and accessories. The featured product is the new pipeless power package. Neon displays will show the operation of a two pressure pump circuit and a motor driven transmission.

You'll meet: F. T. Herrington, v.p. sales; R. E. Esch, general sales manager, E. O. Clark, sales manager, E. J. Doucet, advertising manager and sales engineers: M. R. Fox, P. Barker, J. Arends, A. Van Wormer.

Circle 315 on Reader Service Card

525 A. Schrader's Son Div. of Scovill Manufacturing Co., Inc.



You'll see . . . a display of pneumatic cylinders, all types of operating valves and their various components. Machines will be equipped to demonstrate safety, elimination of fatique, increased production. One of the featured products will be the Lub-air-ator.

Circle 316 on Reader Service Card

1706 The Denison Engineering Company

You'll see . . . operating displays of hydraulic components featuring the recently developed Multipump and a new one ton Multipress. The Multipump is a variable volume vane type unit which offers a wide range of flow and pressure characteristics.

You'll meet: W. C. Denison, president; P. W. Norris, vice president, sales; Denison Neale, R. H. Krepps, Robert C. Clouse, M. G. Sulser, R. H. Bass.

Circle 317 on Reader Service Card

429 Miller Fluid Power Company

You'll see . . . Miller's famous "College of Cylinder Knowledge", revamped and expanded to demonstrate cylinder operation, efficiency, elimination of maintenance, increased production. A new threaded seal-fitting that eliminates leaks of oil and air at pipe threads; double-acting reciprocating boosters which with shop air, cycle continuously to supply a constant flow of oil for hydraulic cylinder operation.

You'll meet: Bruce Rasmussen, Walter Kudlaty, Frank Flick and a flock of engineers turned College Professor.

Circle 318 on Reader Service Card

Circle 140 on Reader Service Card

Specify standard UNBRAKO miniature screws

Set screws and socket head cap screws, sizes #0 through #3

These UNBRAKO miniature screws, made to Class 3 fit, meet the most severe requirements in modern miniature devices. They have accurate sockets, continuous grain flow lines, fully formed threads for tight wrenching and precision fit. Available in heat treated alloy steel or stainless, in a variety of standard lengths. See your authorized industrial distributor for details. Or write us for literature and samples. Unbrako Socket Screw Division, STANDARD PRESSED STEEL CO., Jenkintown 2, Pa.

STANDARD PRESSED STEEL CO.

UNBRAKO SOCKET SCREW DIVISION SPS JENKINTOWN PENNSYLVANIA

SOLENOID OPERATED AIR VALVES

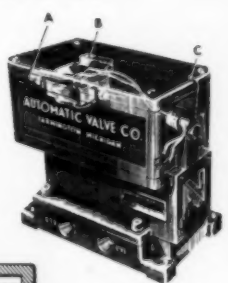
designed to

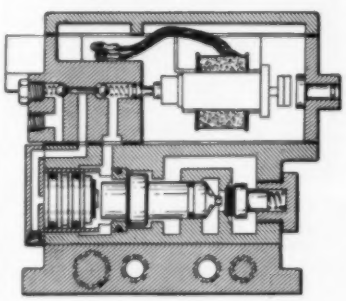
J.I.C.

standards

¼" - ⅜" - ½" - ¾"

4-Way—Model 441





FEATURES

A—Manual Operating Button

B—Water-tight and Dust-tight Solenoid Enclosure with built-in Electrical Junction Box.

C—Cover chained to Body

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AUTOMATIC VALVE CO.

37419 Grand River Ave. • Farmington, Mich.

Circle 13 on Reader Service Card

For top performance under pressure

...8 Pumps for Your Hydraulic Systems

Nos. 53 and 55 for Pressures to 200 psi
Two pump sizes with capacities of 4 to 23.3 gpm and 9 to 34.1 gpm at 0 psi respectively — high-efficiency helical gears — anti-friction bearings.

The 500 Series for Pressures to 500 psi
Six pump sizes with capacities from 5.1 to 37.6 gpm at 0 psi — precision gears — long-lived needle bearings.

Here's the smooth, trouble-free way to pump large volumes of oil at high speeds. These eight Brown & Sharpe Pumps are rotary-geared for positive, reliable action . . . mechanically sealed for leak-proof operation. They've proved themselves in thousands of hydraulic installations. Find out what they can do for *yours*. Write for new Pump Catalog No. 35P. Brown & Sharpe Mfg. Co., Providence 1, R. I., U. S. A.

BUY THROUGH YOUR LOCAL DISTRIBUTOR

B·S

Brown & Sharpe

Circle 23 on Reader Service Card

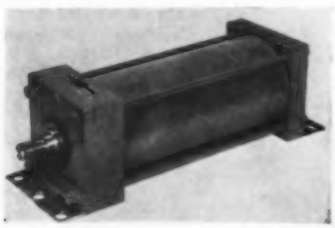
Booth

724 Roto-mation Inc.

You'll see . . . a 1000 pound block of concrete raised and lowered by a small hydraulic rotary actuator. Exploded views will show new seal construction, a drain hole to tank to prevent leakage at the shaft, a manifold plate.
You'll meet: Byron F. Bower, I. W. Killian, Frederick R. Drake, Gil F. Behrend, Victor Stegenga.

Circle 319 on Reader Service Card

324 Rivett Lathe & Grinder Inc.



You'll see . . . a new line of low pressure cylinders. The cylinder is suitable for 150 psi air and 500 psi hydraulic service. There will also be a new line of hydraulic control valves.
You'll meet: A. B. Hunt, president; T. B. Williams, v.p.; J. A. Marsh, sales manager.

Circle 320 on Reader Service Card

696 Ross Operating Valve Co.

You'll see . . . a variety of new air control valves. Many of the valves will be connected to an air supply to demonstrate actual on-the-job working conditions. Featured valves are the standard line of base-mounted valves with the new J.I.C. solenoid and cover assembly. New "all air press circuit" will be shown. It features a non-tie-down valve, single stroke valve and three-way poppet palm button valves.
You'll meet: R. J. Cameron, president; Jack Rowe, v.p.; Jack Neun, Frank Nowack, D. A. Ditirro, A. B. Huntington, and Herbert Gailey.

Circle 321 on Reader Service Card

237 Modernair Corporation

You'll see . . . typical air circuits in operation. New products being exhibited include a 3-way sleeve valve for in-line use with clamp type cylinders, series of 2 and 3 inch bore clamp cylinders, ¼ inch solenoid operated 4-way valves, and a line of heavy duty air cylinders and electric-operated directional control-subplate mounted valves meeting J.I.C. specifications.
You'll meet: John E. Goldring, president, Wm. W. Burke, sales manager, and Lloyd Cowdin, assistant sales manager.

Circle 322 on Reader Service Card

308 A. W. Cash Company

You'll see . . . a number of hydraulic valves and actuators plus some general purpose pressure regulators. The featured product will be a new hydraulic turret lathe drive for powering ram-type hand turret lathes.
You'll meet: W. S. Mattingly, H. M. Kirkby, E. E. Tinker, G. S. Hale, R. D. Hiser, L. D. Kling.

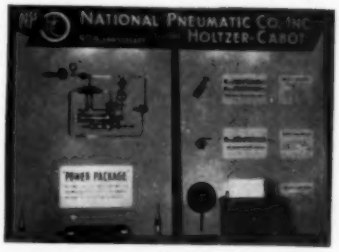
Circle 323 on Reader Service Card

321 Hydro-Line Manufacturing Co.

You'll see . . . an operating display of precision machine tool slide hydraulic cylinders, heavy duty high pressure hydraulic cylinders, low pressure hydraulic cylinders, and heavy duty air cylinders.
You'll meet: Jack L. Modrich, John Harding, Mark Tull, Roger Schumacher, Stuart Taylor.

Circle 324 on Reader Service Card

244 National Pneumatic Co., Inc. and Holtzer-Cabot Divisions



You'll see . . . a working model of an air-hydraulic power package. Cylinder barrels will be lucite to permit seeing "the innerds" in action. The combination of the air cylinder and hydraulic power check offers the speed and economy of air for fast approach with the controlled precision of hydraulics during the machine cycle.
You'll meet: Charles W. Ledig, sales manager; and field representatives, Robert A. Broten, and Paul E. Morgan.

Circle 325 on Reader Service Card

215 Mead Specialities Company

You'll see . . . in addition to their irregular line of single-acting and double-acting air cylinders and air valves, working samples of air presses, air vises, air impact hammers, air hydraulic index and reciprocating work feeders. Feature item will be the "Fluid Feed" air-hydraulic drill press feed.
You'll meet: H. O. Henwood, v.p. and sales manager; E. G. Case, Bob Thorsen, Donald Finlayson and Clare Rych.

Circle 326 on Reader Service Card

760 True-Trace Sales Corp.

You'll see . . . a three dimensional equipped Gorton Mill which has the unusual feature of manual screw feed in three directional motion plus the tracer control.
You'll meet: George F. Frey, president; Roy Rosebrook, v.p. and chief engineer; Leo M. Cross, sales manager.

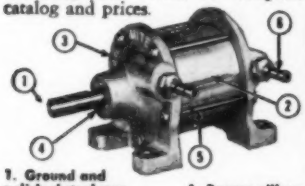
Circle 327 on Reader Service Card

Circle 4 on Reader Service Card

AIR-MITE AIR CYLINDERS

Low Cost . . . Compact . . . Powerful . . . Rugged

AIR-MITE Cylinders—made in single or double acting series—in 4 mounting types, are high quality cylinders at a low price. Simple, rugged design and compact construction give them long life, permit easy mounting on jigs, fixtures, tools, or machines. Used wherever power holding, pushing, pulling or lifting is required, AIR-MITE cylinders will meet your most exacting standards of dependability and long life. Write for complete catalog and prices.



1. Ground and polished steel ram
2. Brass, true-bore cylinders
3. High strength aluminum alloy cylinder heads
4. Bronze oilless ram bushing
5. Five steel tie rods
6. Brass hose stems

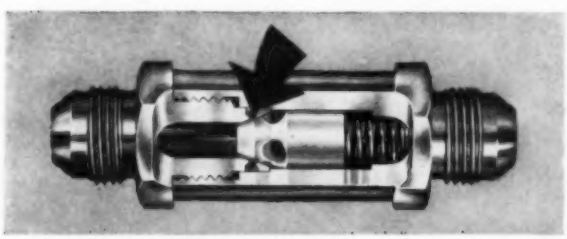
4 Mounting Types

AIR-MITE Devices, Inc.

4418 W. CARROLL AVENUE • CHICAGO 24, ILLINOIS

The FLEXIBLE SEAL SEAT*

Simple, Secure, Long-Lasting!



Responsive action of the soft O-ring seal provides absolute leak-tightness. Instantly compresses to seal internal and external pressures. Draws harmlessly around dirt particles. No costly precision parts; no extra end seals. Stocked in 6 standard Dryseal pipe and JIC tube sizes; 12 connection combinations. Write for data sheet.

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7321 West 59th Street • Summit, Illinois

Kep-O-seal

HYDRAULIC & PNEUMATIC
CHECK VALVES

* PATENT APPLIED FOR

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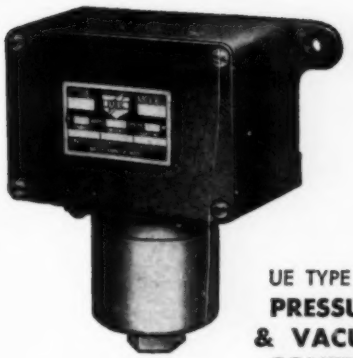
AUTOMATIC PRESSURE or VACUUM CONTROL J6



UE TYPE J6 PRESSURE & VACUUM CONTROL

UNITED ELECTRIC TYPE J6 unit is designed to automatically control either pressure or vacuum . . . has a fixed, uniform on-off differential as specified between limits of 3" WC to 2 PSI . . . and a maximum controlling pressure of 180 PSI. It is a sensitive, weatherproof, precision built control with good repeatability. Recommended for all pressure or vacuum applications which require close on-off differential control.

Switch Differential	Fixed as specified between limits of 3" WC to 2 PSI.
Switch Ratings	15 or 20 amps at 115 or 230 volts AC, also DC switches upon specification.
Switch Types	N.O., N.C., or Double Throw, no neutral position.
Size	4¾" x 4 27/32" x 2 5/16".
Weight	Approx. 1 lb. 8 oz.
Electrical Connection	½" NPT conduit opening in enclosure, screw type terminals on switch is standard.
Enclosure	Die-cast aluminum case, black wrinkle finish standard.
Mounting	Surface mounted—by 2 mounting ears.
Bellows	Seamless brass—spring loaded.
Pressure Connection	¼" NPT female connection.

UNITED ELECTRIC *manufactures a complete line of temperature, pressure and vacuum controls. UE will gladly modify or custom-build a unit to your specifications. Consult a UE application engineer today.*

Write for Bulletin No. 5-3 for complete J6 data.

United Electric Controls COMPANY
80 SCHOOL STREET, WATERTOWN, MASS.

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AMERICAN CRUCIBLE knows Bearings!

Send Prints for Quotation

When you are looking for bearings, bushings and wearing parts that will stay on the job and give trouble-free service—SWITCH TO

Promet Engineered Bronze

GET THE GOOD, SOUND QUALITY THAT ASSURES EXCELLENT PERFORMANCE

Discuss your bearing problems with our metallurgists, engineers, and laboratory technicians. This service will in no way obligate you. Write for free literature and service data sheets or send blueprints, conditions of operation and data for recommendations and quotations.

THE American Crucible PRODUCTS CO.

"Bearing Specialists Since 1919"

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Please send free literature and service data sheets on Promet Bronze.

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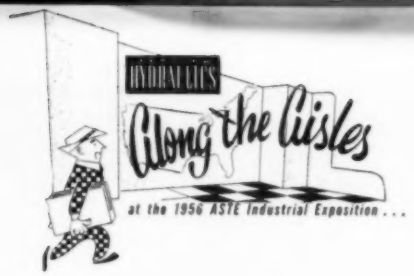


Booth

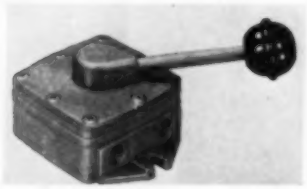
325 C. A. Norgren Co.

You'll see . . . color transparencies of air filters, pressure regulators and lubricators, as well as a wide assortment of case histories. Among the new products featured will be the ¾ and 1 inch automatic-drain filters.

You'll meet: D. G. Faust, v.p. of sales and advertising; W. O. Hall, chief field engineer, Don Robb, and Frank Goll.

Circle 328 on Reader Service Card

158 Hannifin Corporation



You'll see . . . square steel head hydraulic cylinders rated at 2000 psi which feature an externally removable bronze cartridge gland. Also new square steel head air cylinders for 200 psi air or oil. There will be the broadened and improved line of pilot-master air control valves. New featured product is the "Lap Seal" valve which is a packless, 4-way, rotary disc type, hand operated type air valve.

You'll meet: E. G. Peterson, president; O. J. Maha, v-p sales; R. G. Broberg, A. W. Blackshaw, W. C. Thompson, H. J. Andresen, Z. L. Lansky.

Circle 329 on Reader Service Card

1028 Marvel Engineering Company

You'll see . . . various sizes of Marvel Synclinal filters for filtration of hydraulic oils, fire-resistant fluids, coolants, lubricants and water for use in low pressure circulating systems. Simulated hydraulic pumping unit will show typical installations, under actual operating conditions, of both the sump and line type units.

You'll meet: W. F. Dollinger, Jr., Wm. A. Thomas, M. J. Stevens, and R. Becvar.

Circle 330 on Reader Service Card

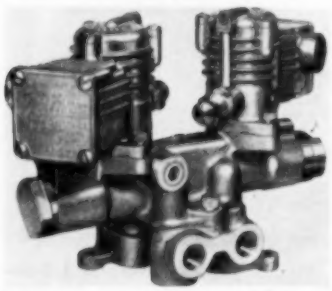
225 The Tomkins-Johnson Co.

You'll see . . . a display of air and hydraulic cylinders both the tie rod type and the new spacemaker design.

You'll meet: Mrs. D. M. Tracey, president, W. J. Donnelly, plant manager, W. J. Remund, sales manager, and G. B. Cranor, chief engineer.

Circle 331 on Reader Service Card

130 Valvair Corporation



You'll see . . . Speed King air valves in operation underwater and also in a dust chamber. In the dust chamber, the valve will be partly buried in sand. The sand will be agitated by air jets to create a dust spray on the valve during operation. Both these displays will provide dramatic demonstrations of the valve seals.

Circle 332 on Reader Service Card

229 Racine Hydraulics & Machinery Inc.

You'll see . . . displays of variable vane pumps, boosters, 4-way, 2-way, flow control and pressure control valves, and package power units. Featured product is the recently introduced 2000 psi double solenoid 4-way valve.

You'll meet: John E. Erskine, exec v-p; H. A. Schultz, v-p sales; George B. Miller, chief engineer, Robert D. Rynders, C. O. Brietsprecher.

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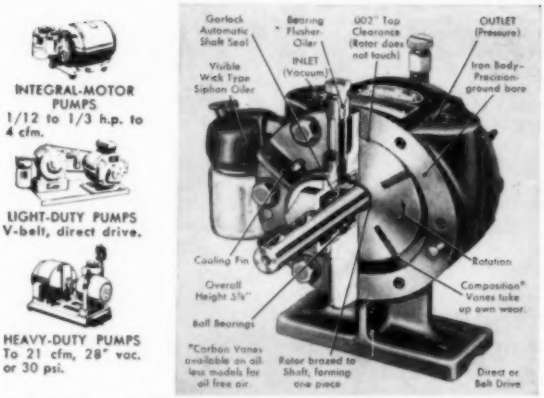
Circle 55 on Reader Service Card


INTEGRAL-MOTOR PUMPS
1/12 to 1/3 h.p. to 4 cfm.
LIGHT-DUTY PUMPS
V-belt, direct drive.
HEAVY-DUTY PUMPS
To 21 cfm, 28" vac. or 30 psi.
Garlock Automatic Shaft Seal
Bearing Flusher-Oiler
.002" Top Clearance (Rotor does not touch)
OUTLET (Pressure)
Visible Wick Type Siphon Oiler
INLET (Vacuum)
Iron Body-Precision-ground bore
Cooling Fin
Rotation
Overall Height 5⅞"
Composition* Vanes take up own wear.
Ball Bearings
*Carbon Vanes available on all less models for oil free air.
Rotor brazed to Shaft, forming one piece
Direct or Belt Drive

Quality and simplicity keep efficiency high on

GAST rotary vane AIR PUMPS

This cutaway reveals why Gast Air Pumps are in demand for plant use and original equipment. Manufactured to high quality-precision standards, all models embody this efficient, simple rotary-vane design. Rotor is balanced; sliding vanes light in weight for minimum motion-energy-friction loss compared to other pumps. As vanes take up their own wear automatically, pump delivers full performance for years.

Write for "Application Ideas" booklet and catalog—mention capacity you need! Gast Manufacturing Corp. P. O. Box 117--D, Benton Harbor, Michigan.

Original Equipment Manufacturers for Over 25 Years

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- AIR MOTORS TO 4 H.P.
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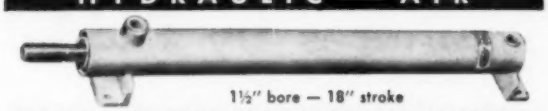
See Our Catalog in Sweet's Product Design File

CYLINDERS
HYDRAULIC — AIR



1½" bore — 18" stroke

NEED A SPECIAL CYLINDER IN A HURRY?

Ask Us ! — We specialize . . .

in designing cylinders to your application — 1 cylinder or a 1000 — we're happy to be of service.

Available bores with strokes to 10 feet: 1½", 2", 2½", 3", 3½", 4" and 5".

Available bores with strokes to 1 foot: 6", 8", 10", 12", 14", 16" and 18".

Packings available — "O" rings, Block Vee Homogeneous, Piston Cups and Vee Type Packings.

Mounts available — Flange, Foot, Trunnion, Clevis, etc. or to your specs. Working pressures to 4000 P.S.I.

10" bore—8" stroke

CHECK THESE CONSTRUCTION FEATURES:

1. Barrel roller burnished from especially smooth tubing.
2. Tough Aluminum alloy — Head and Piston.
3. Light weight for easy handling.
4. Clean design — No Draw Bolts.
5. Precision manufactured on turret lathes. Piston type accumulators available.

Areas open to distributors in the East.

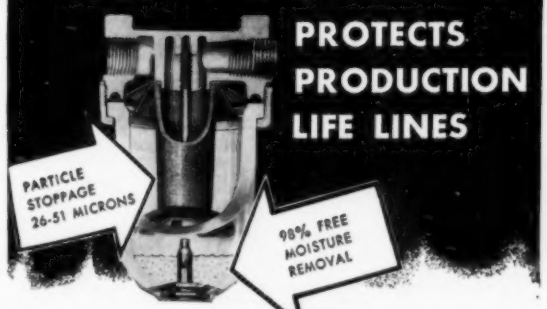
Write or Call —

HEMCO MFG., INC.

Argonia, Kansas Phone 160

STEEL HEMCO PRODUCTS

Arrow AIR LINE FILTER



Arrow Autopneumatic Controls Prevent Work Stoppage — Save Repairs

- *IMPROVE MACHINE AND TOOL EFFICIENCY*
- *LOWER MAINTENANCE AND REPAIR COSTS*
- *LESS AIR POWER WASTE— HIGHER OUTPUT*

You get every ounce of performance out of your air-powered equipment, cylinders, valves, impact wrenches, tools, etc. with the ARROW AUTOPNEUMATIC CONTROL ASSEMBLY. The compressed air is properly cleaned. The Regulator Valve controls pressure without waste of air and the ARROW Lubricator supplies the correct amount of fine oil mist in the air stream to properly lubricate appliances or tools in operation. The Automatic Trap discharges accumulated sludge to give perfectly *conditioned and controlled compressed air* for uninterrupted production schedules.

Tool down-time, operator lost time, parts replacements and expensive repairs are practically eliminated.

All the Facts Are Yours for the Asking

Let ARROW field consultants point the way to better production economy at no cost to you. ARROW will be happy to send you their engineering catalog and make recommendations.

Your inquiries invited.

ARROW TOOLS, INC.

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Circle 12 on Reader Service Card

STRONG AS STEEL...
but 40% lighter!

Shatterproof air-storage spheres by Kidde!

Pressurized air containers – strong enough to handle pressures up to 5000 psi, yet 40% lighter than their steel counterparts – have been perfected by Kidde aviation engineers.

Now available in volumes of from 50 to 5,000 cubic inches, lightweight Kidde spheres retain their physical characteristics at the higher temperatures encountered in today's high-speed aircraft. Made of fiberglass wound on a non-porous liner, Kidde spheres are fabricated on Kidde-designed winding machines which laminate the fiberglass strands in a scientific pattern which equalizes stresses. A special epoxy resin binder gives firm support to the strands and permits the making of a 650 cubic-inch, 3,000 psi sphere weighing only 12¼ pounds, as compared to an equivalent steel sphere of 20½ pounds.

Developed for aircraft, lightweight Kidde spheres represent a tremendous stride toward weight reduction of pneumatic system components without any loss in strength – a vital factor when considered in terms of range, payload or fire power!

In other air-storage applications – especially where portability is of prime importance—Kidde spheres afford the same weight-saving advantages. They are the strongest lightweight containers of their kind on the market today!

For more information about Kidde spheres and how they may solve your compressed air or gas problems, write Kidde today!

Kidde *The words 'Kidde', 'Lux' and the Kidde seal are trademarks of Walter Kidde & Company, Inc.*

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300 cubic inches | 650 cubic inches | 900 cubic inches | 1300 cubic inches

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hydraulics • pneumatics

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HYDRAULIC POWERED FLYING CONTROLS

In the February issue, part I described the Servodyne and Fairey Hydrobooster. Two more servo systems used on British aircraft are discussed in this concluding article.

• By John A. Lankester

European Editor, APPLIED HYDRAULICS Magazine

THE Boulton Paul system of powered flying controls approaches the basic problem of varying the direction of fluid flow by the movement of the pilot's control column in a different way from the systems described in Part 1. Instead of employing a selector valve to direct the pump output, the Boulton Paul system uses a variable delivery pump to force the desired volume of oil, at the desired rate of flow, direct to whichever side of the actuating cylinder is required. In this circuit, Figure 1, the hydraulic pressure generator is a variable displacement pump and is connected permanently to both sides of the actuator, whether this is a hydraulic cylinder or motor. This radial piston pump houses a revolving cylinder block, containing the pistons, which rotates around a central fixed hub in which the oil passages are drilled.

Surrounding this assembly is a circular track ring against which the pistons bear; the track ring is pivoted to allow it to swing from an eccentric position on one side of the center line, through the concentric setting, to a position (also eccentric) on the other side of the center line. Fluid is displaced by the pistons only when the track ring is off-center. In the concentric position no stroke is imparted to the pistons, consequently delivery is zero. Displacement of the track ring to the left will cause the pistons in the right hand sector to move inwards expelling oil to the right-hand end of the cylinder, thus moving the piston to the left. At the same time, oil exhausted from the left end of the cylinder will be drawn into the cylinders in the left-hand sector of the pump whose pistons are stroking outwards. Conversely, displacement of the track ring to the right of the center line will expel oil to the left side of the cylinder moving the piston to the right.

In this way the direction of control movement is governed, not by a directional selector valve, but

by the position of the track ring of the pump itself and it is therefore only necessary to link this ring to the pilot's column by suitable means to enable him to control the direction of fluid pumped to the cylinder. A link from the ram-end to the track ring via the differential gear box and servo-valve provides the follow-up mechanism to centralize the ring when the appropriate movement of the control has been accomplished. To displace the track ring, a servo-pump is built into the unit. This servo pump provides a supply of pressure oil, which, directed by the servo-valve, enables the pilot to shift the track ring. Output of the servo-pump is regulated by a balance piston connected to the main servo pressure line. When demand on the servo supply causes a drop in pressure, the spring, overcoming its opposing pressure piston, increases the eccentricity of the servo-pump track-ring, thus stepping up the output of the pump until equilibrium is restored. This servo circuit also feeds the main actuating system through make-up valves to ensure that the power circuit is always fully charged with oil. Blow-off valves located between the ram lines, and also in the servo balance valve, take care of any sudden shock loads or other dangerous pressure build-up. A differential gear box transmits the pilot's input signal to the servo valve and a connection from the output end of the ram rod cancels out the positional error produced by this signal. In this, as in most hydraulic flight control installations, a reversible hydraulic motor can be used in place of the ram, according to design requirements and choice.

The Boulton Paul system embodies electric motor drives for the hydraulic pumps which makes them independent of the main aircraft engines. The normal battery installation is capable of driving these motors even if the output of the aircraft electrical generators should be cut because of failure.

The system is duplicated for safety. If for any reason the servo-valve should seize, a trip mechanism operates a pump lock valve which locks the main pumping elements in the concentric or no-pumping position. This eliminates any risk of the pump track ring being held, or sticking, in such a position as would force the cylinder to the full extent of its travel, with obviously serious consequences to the control of the aircraft.

HOBSON FLIGHT CONTROL SYSTEM

Numerous types of control are manufactured by H. M. Hobson, Ltd., and these include both piston and screw jack designs. Here's how one form of screw jack control operates. Motive power to drive the hydraulic pump is developed by a direct coupled electric motor; the output from the pump is directed, according to the movement of the control column, through a relay valve which gives directional control to a reversible hydraulic motor; the rotational movement derived from the hydraulic motor is converted into linear movement, via a train of gears and bevel pinions, by a screw jack. The linear travel of the screw jack is finally translated into semi-rotary motion to move the control

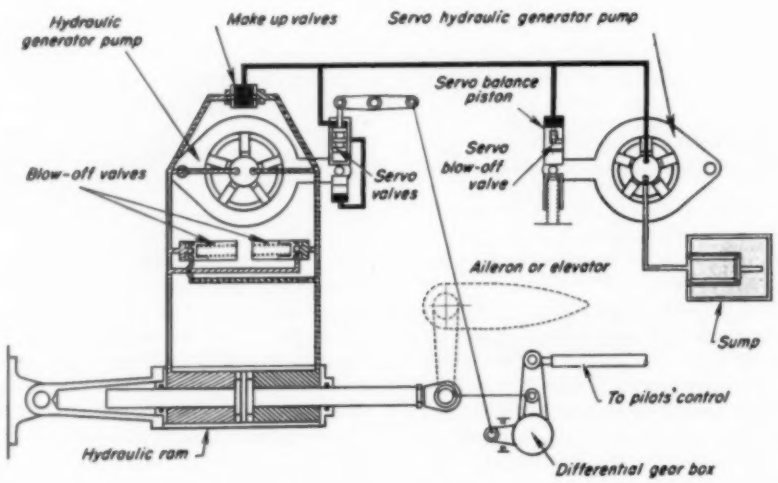
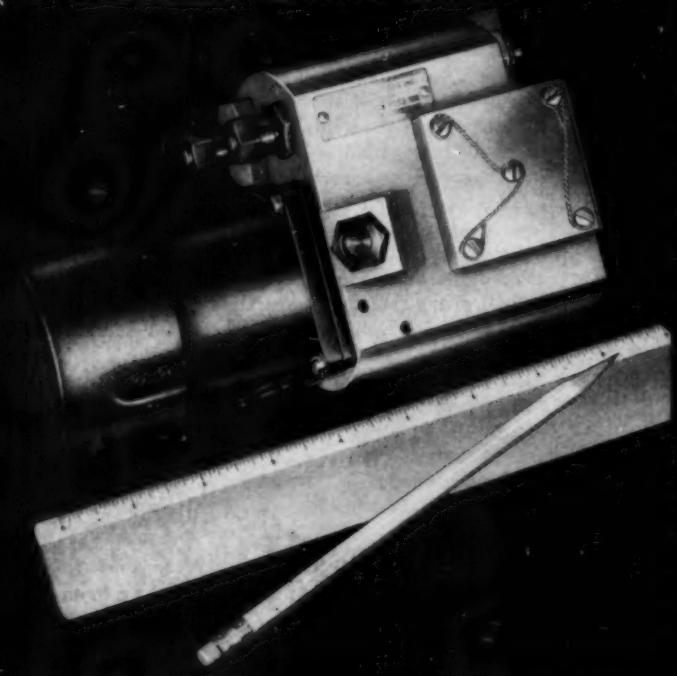


FIG. 1. DIRECTION and speed of the hydraulic ram is controlled by the pumping action of the variable volume pump. Servo pump supplies power to position the main pump in response to the pilot's control.

Circle 43

AIRCRAFT-TYPE
hydraulic
POWER UNITS . . .



To supply dependable hydraulic power for critical applications, Eastern units are engineered to perform under extreme conditions. Compact design and varying motor sizes make them unique power sources, especially desirable for airborne use. The equipment illustrated in detail presents a typical Eastern Power Unit designed for one application. Many other requirements can be satisfied with designs of this general type.

Unit consists of: positive-displacement pump, electric motor drive, oil reservoir, expansion chamber, porous bronze ten-micron filter, pressure regulating valve, filter relief valve, and expansion relief valve.

SPECIAL UNITS to be built into Servo Systems and specialized projects are available. As illustrated below, Actuators combined Servo-valve and Actuator, and Servo-valve Hydraulic System combinations are being produced by Eastern for custom-specified jobs. If your project involves equipment of this type, write to us for further information.

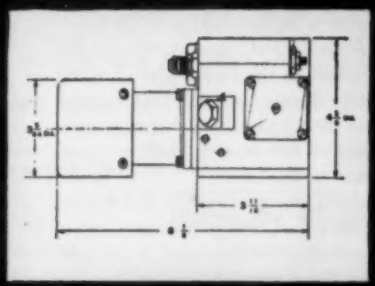
Specifications:

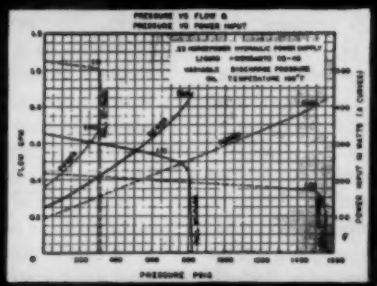
Available with either ⅛, ¼, or ½ horsepower motor, in 28 V. D.C. or 400 Cycles 3 Phase power.

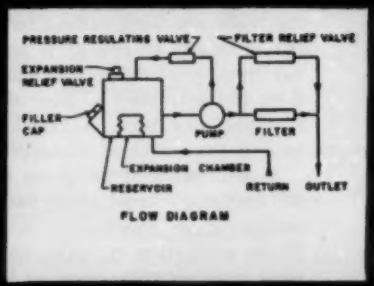
Available with various pump characteristics. Under certain operating conditions, units can be made self-cooling. *Example*: ¼ H.P. Unit has a continuous-duty oil-temperature rise above ambient of approximately 60 F. at sea level.

Pressure range from 0 to 1500 PSIG with compatible flow.

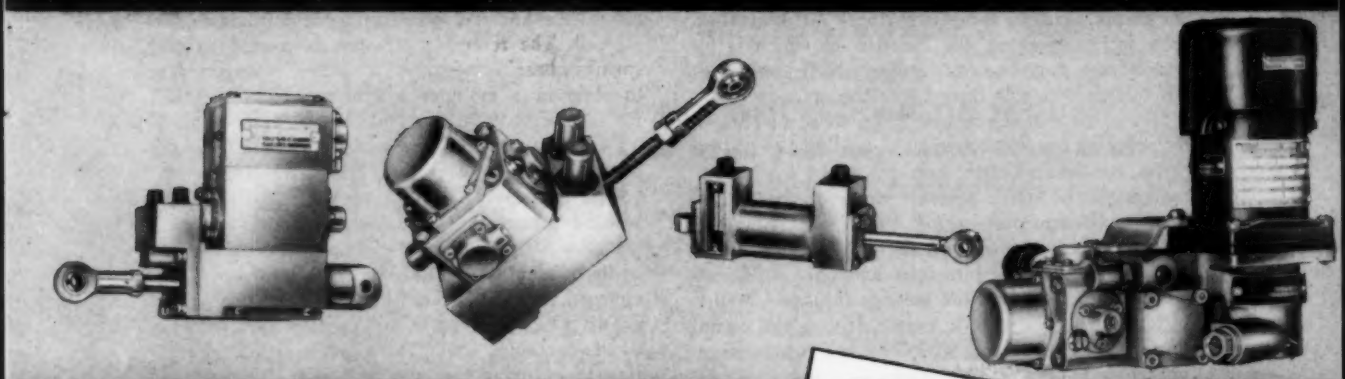
Anodized aluminum body contains all components except motor.







FLOW DIAGRAM



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surfaces of the aircraft by means of the skew hinges by which they are attached to the airframe.

This control is of the duplicated type with both halves running continuously during normal operation. This essential safeguard against failure enables a faulty half to drop out of action without in any way preventing the sound half from maintaining powered operation of the screw jack, although in these circumstances the working section will continue functioning at a reduced overall power output.

Several points of interest emerge from a detailed study of this system. First, the entire duplicated assembly is built into a single, compact, space-saving unit, thus eliminating the piping usually associated with hydraulic controls. This, of course, saves weight, and, as all the oil passages are drilled in the housing, the friction losses are kept low and the safety factor high.

Second, careful consideration has been given to the demands made by the controls on the pump output. For instance, in slow speed flight the loads on the controls surfaces are comparatively light requiring only a moderate hydraulic pressure to deal with them, but the degree of movement is usually high necessitating a fast rate of flow to ensure speedy response. Conversely, at high speed, the loads are high calling for high pressure, but the extent of movement is small so that a comparatively small delivery rate is acceptable. To meet these characteristics of high delivery at low pressure and vice versa, a variable delivery pump is used as the source of oil supply.

A description of the pump appeared in APPLIED HYDRAULICS, August 1954, issue, and only a brief outline of its functioning is therefore necessary. Of the multi-stage type, this pump comprises a first stage gear pump charging, at low pressure, the cylinders of a second, high pressure stage radial piston pump. Between these two stages an unloading valve is incorporated, the function of which is to bypass the stage-one oil, progressively reducing the volume which is forced into the stage-two cylinders as the outlet pressure from these increases. By reducing the volume of fluid feeding the piston pump, its delivery rate, initially about 5 gpm, is reduced in the higher pressure range up to a point where maximum pressure of 3,000 psi. is attained. At this point practically all the low pressure oil is being bypassed back into inlet and only sufficient volume to compensate for seepage is passed to the piston pump. The electric motor driving the pump has a continuous rating of 1.5 hp and a maximum operational speed of 5,800 rpm.

The direction or rotation of the hydraulic motor is governed by the relay valve which consists of a ported cylinder housing a "landed" spool. Although this arrangement is widely used for flow control, certain refinements are added to take care of possible failure, due to seizure of the spool in its housing. If this should occur, control is safeguarded by a break-link which is designed to yield at a given loading and permit the pilot's control linkage to operate without moving, or being impeded by, the seized valve. This break-link also actuates a short-circuiting valve to open both the inlet and exhaust ports of the hydraulic motor on the faulty side of the unit, thus freeing it to be moved by the sound hydraulic motor without affecting the control of the aircraft. Simultaneously the collapse of one break-link locks the other to ensure that the remaining relay valve continues to receive the pilot's signals. So the seizure of one selector only renders one half of the assembly inoperative while allowing it to follow passively the movements of the other half.

The hydraulic motor is of the swash-plate type having seven axial pistons the ends of which bear upon a swash-plate inclined at an angle of 12 degrees to the axis of the motor shaft. This shaft also carries an eccentric for the purpose of reciprocating the seven radially positioned valves; each valve

. . . light weight, little friction loss, fail-safe operation, pilot "feel" . . . these are the extras which must be designed into a flight control.

stem has two lands alternatively to connect the respective motor cylinder with the fluid inlet and outlet ports. As a piston is forced through its driving stroke a thrust is applied to the swash-plate forcing it to revolve the inclined axis through 180 degrees about the axis of the unit and, since this axis constitutes the center part of the driving shaft, a circular motion is imparted to the latter.

Each half of the duplicating assembly is supplied with oil from a specially designed pressurized reservoir that is precharged and incorporated in the self-contained system. By this means a constant head is maintained to the gear stage of the pumps regardless of the altitude, acceleration or attitude of the aircraft. The reservoir pressure is created by coil springs bearing against a sealed plunger free to slide in a cylinder assembly which is finned for cooling. Returning oil from the system is brought into the reservoir via a labyrinth in the outer chamber adjacent to the fins. When the reservoir is pressure-primed the pressure applied to the piston increases to a maximum of approximately 20 psi at which the plunger bottoms against the end of its housing, thereafter continued priming is discharged through a relief valve set to lift at about 75 psi which also takes care of thermal expansion of the contained fluid. This pressurization, in addition to ensuring that the pumps are always fully charged, also assists in keeping the circuit free from air which would have an adverse effect on the solidity of the whole system. An indicator respon-

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sive to reservoir piston movement, gives visual warning of the need for repriming.

Throughout the design, considerable care has been taken to ensure correct lubrication of all components and moving parts and also that the effect of temperature changes are compensated, since these would affect the viscosity of the fluid and thus the response of the whole control. Cooling air is ducted to the reservoir via a shutter thermostatically controlled by a device known as the "thrustat". This is a cylindrical brass body containing a special wax preparation having a high initial coefficient of expansion. If the wax becomes overheated it expands and forces out a sealed plunger which opens the shutter to increase the flow of cooling air.

DESIGN OF A FEEL SIMULATOR

Because the Hobson design, is the irreversible type, it does not afford any "feel" back to the pilot and for this reason it is necessary for the aircraft to be fitted with a synthetic "feel simulator" device. The Hobson Feel Simulator takes the form of a special diaphragm valve, controlling a synthetic feel simulator jack linked to the column. The feel simulator control, illustrated in Figure 2 houses a diaphragm, one side of which is connected to a pitot pressure tube, the other side being connected to atmospheric, static pressure in much the same way as the conventional airspeed indicator. Linked to the diaphragm is an hydraulic valve which controls the extent of the pressure applied to the simulator jack. As the speed increases, the pitot pressure increases relative to the static pressure and, deflecting the diaphragm, opens the hydraulic valve to admit greater pressure to the simulator jack. Since this is directly connected to the column the greater the pressure in it the greater the effort necessary to move it. In this way the force required to move the column is governed by the airspeed and the components of this simulator are so designed that the resistance applied by the jack is proportional to the square of the airspeed.

Application of power to aircraft control systems has been made a great deal easier by the use of hydraulics, and the knowledge and experience gained in the production of the simpler landing gear, wing flap, and bomb door operating circuits has been of the greatest benefit in the successful development of the power flying control. It would be difficult to imagine just how the successful coupling of power assistance to flight controls could be achieved by other means, and though high pressure pneumatic systems for aircraft are now making progress it seems doubtful if compressed air will ever supplant hydraulics in this particular application. Just as there are few aircraft today, unless built for a specific purpose, which do not have retracting landing gear, so it will probably not be very long before almost every aircraft embodies some form of power assistance to operate the flight controls. If today's trends are any indication of the future pattern, the major part of such developments lies in the hands of the designers of hydraulic components and systems. ▼▼▼

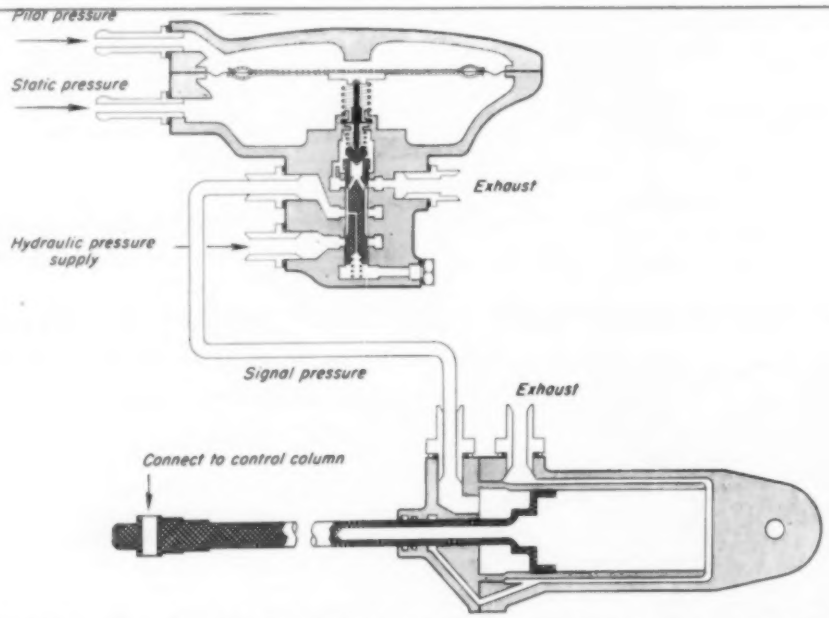
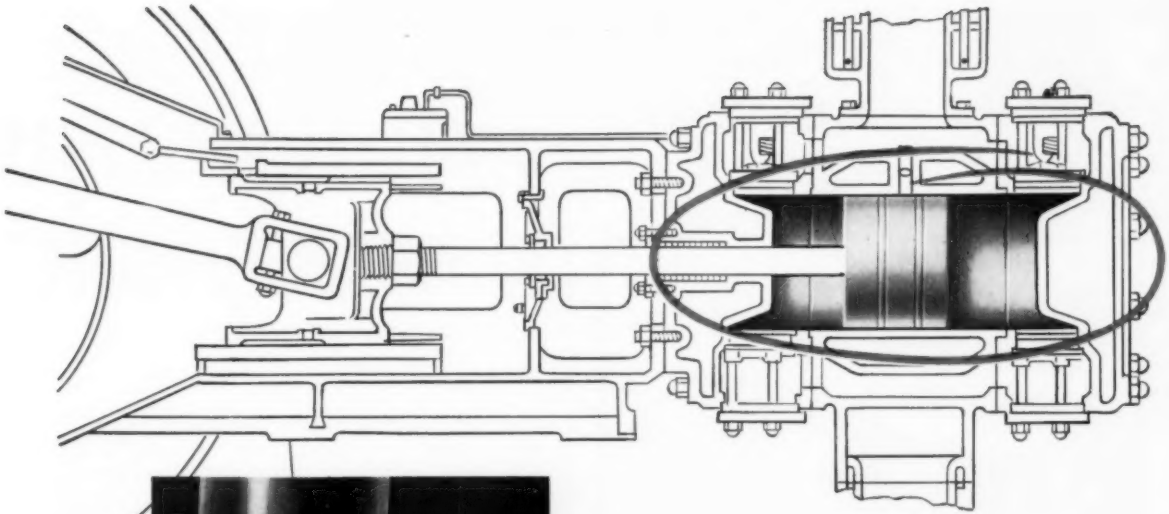
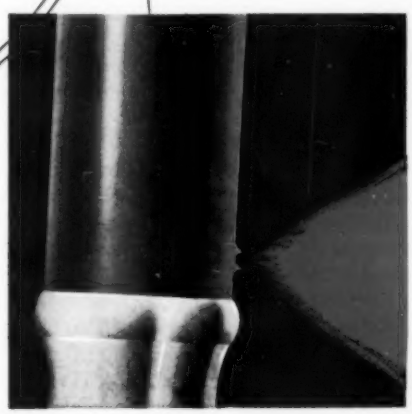


FIG. 2. FEEL simulator makes the force required to move the control column a function of air speed.





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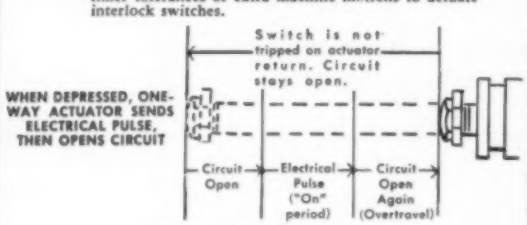
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HIGH TEMPERATURE AT TURBOJET

The first turbojet engine hydraulic symposium, sponsored by Vickers, Inc., held at the Park Shelton Hotel, Detroit, on Thursday and Friday, February 2 and 3, was attended by more than 80 representatives of leading engine, airline and supplier organizations. Major attention was given to high temperature problems components and fluids.

After introductory remarks by Dr. N. E. Edlefsen, Vice President, Vickers, Inc., William Lucas, Continental Aviation and Engineering Corporation, took the chair for the morning session. The opening paper, "The Effect of Power Extraction on Two Spool Turbojet Engines", by E. M. Ramberg and A. E. Gonsolus of Parameters, Incorporated, was delivered by Mr. Ramberg. The two methods of extracting power for engine and aircraft accessories —air extraction or "air bleed" and mechanical power extraction—were reviewed from a theoretical design point of view with graphs and charts shown to illustrate the important criteria that could be applied. The two most important criteria used as a basis were the effect of power extraction on engine thrust and on specific fuel consumption.

POWERED BY AIR OR OIL?

The second paper, "A Comparison of Hydraulic and Pneumatic Accessory Power Generation" by E. I. Brown, Chief Engineer, El Segundo Engineering Section, Vickers, Inc., was primarily concerned with the relative merits of hydraulic and pneumatic power packages for accessory operation. The relative advantages of economy of fuel and weight and of engine performance were outlined. The basic unit—a single power package in either case to drive a variable volume pump from each engine was discussed. The development of suitable air turbines as part of a pneumatic package was given as one reason why the pneumatic system was gaining in favor in new designs. Mr. Brown also discussed the pressurized reservoir and emphasized the critical importance of the sealed or airless hydraulic circuits.

The third paper on the first morning was of particular interest because it gave the first full scale, detailed description of a new servo pump. In the paper, "Servo Pump vs Servo Valve Controls", Leroy D. Taylor, chief designer electro-hydraulic

PROBLEMS FEATURED ENGINE SYMPOSIUM

servos, Vickers, Inc., illustrated and described in detail the servo pump. The major features of this pump were given as: (1) a variable displacement pump in which rate and direction of delivery of fluid from pump can be varied and controlled; (2) ability of a small amount of power input in relation to the pump's power capabilities; and (3) the unit has been made as self sufficient as possible. A metering valve, controlled either by a mechanical linkage or an electro-mechanical transducer or torque motor, operates a stroking piston which rotates or strokes a yoke about its pintles. In the same case are two auxiliary pumps with relief valves; one maintains control pressure to the stroking system, the other supplies replenishing and supercharge oil. In effect, the servo pump is a complete hydraulic system in itself, except for a sump and cooler.

Mr. Taylor also reviewed typical servo valves for jet engine applications. He pointed out the advantages as: (1) faster response than servo pumps; (2) greater simplicity than a servo pump; and (3) in most cases, lighter weight. The factors which must be considered in making a choice include: rate of response, stability, power losses and weight.

R. G. Dennys, Orenda Engines, Ltd. (Montreal) was chairman at the afternoon session at which two papers were given. K. I. Postel, Chief Design Engineer, Vickers, Inc., in his paper, "Progress in the Development of High Temperature Components", clarified "high temperature" by reviewing the SAE classification: (1) systems with maximum fluid temperature of 275 F and expected life of 560 hours; (2) systems with maximum temperatures of 400 F and expected life of 200 hours; and (3) systems with maximum temperature of 550 F and expected life of 10 hours. The 275 F specification calls for an inlet temperature of 240 F, allowing a 35 F temperature rise in the pump. The major difficulty remains with sealing. The 400 F specification, designed to meet the needs of present engines and to supply control and utility functions on advanced high performance airplanes, has a 200 hour life specification only because pump manufacturers have not been able to meet the longer life requirement. The 550 F specification is primarily for missile work.

The second paper was given by A. B. Billet, Staff Engineer, Airborne Products Department,

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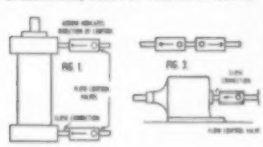

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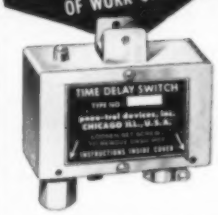

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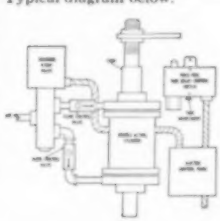

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JET AIRCRAFT SYMPOSIUM

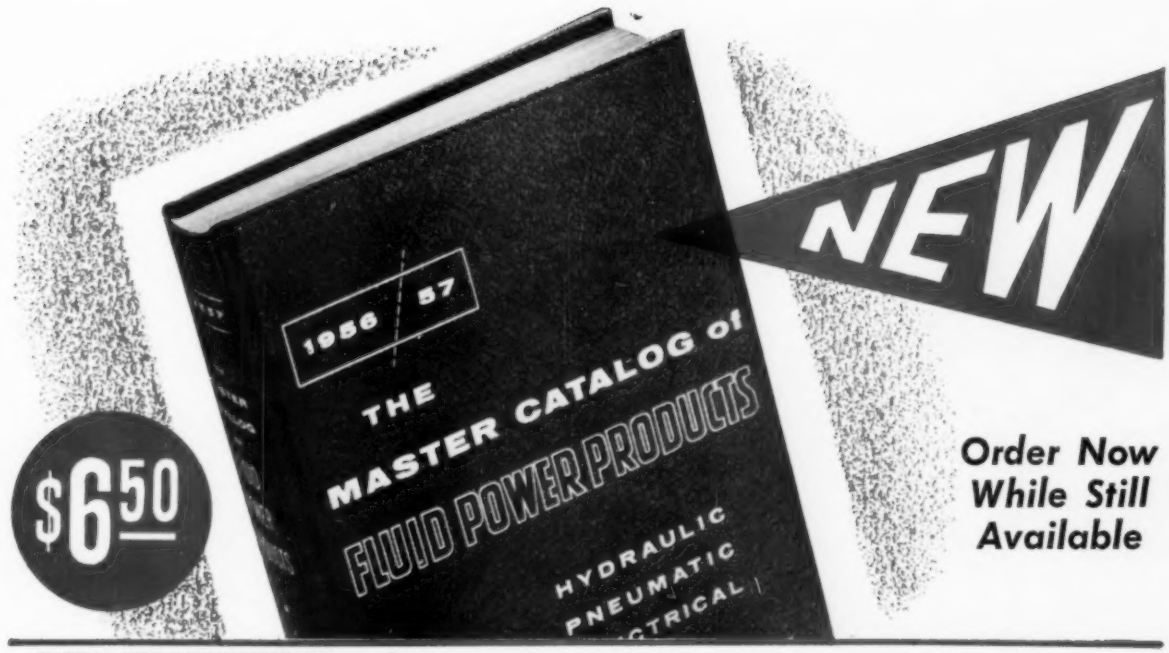
Vickers, Inc., In his "High Temperature Hydraulic Pump Qualification Testing" he pointed out that elaborate test equipment is necessary for testing pumps for jet engines. The Vickers laboratory set-up for 550 F testing was described and illustrated in some detail. He touched briefly on the fluids used at three categories: MIL-L-7808 for 275—325 F; OS-45 type fluid for 350-450 F; and MLO-8200 family of fluids for 550 F. He reminded his audience that while no military specification for high temperature pumps exists at the present time, portions of a proposed specification (MIL-P-7740) and customer versions written around engine specification MIL-E-5009A, are in use at the present time. Some difficulties are being experienced by the incompatibility of various engine control components. Filters of several types (sintered bronze nickle plated, sintered stainless steel, stainless steel mesh, paper and synthetic paper elements) have been tested; no generally satisfactory solution has been found. On seals, he mentioned that some success had been obtained with stainless steel, metal "O" ring type seals and, for shaft seals, that a carbon sealing element showed some promise.

WHAT'S BEING DONE ABOUT FLUIDS?

On the second day of the symposium all four papers were devoted to high temperature fluids. P. H. Scheffler, Westinghouse (AGT) Division, was chairman during the day. The first paper, "Hydraulic Fluids for High Temperature Systems" prepared by Lt. H. S. Schiefer and B. Rubin, Materials Laboratory, WADC, and read by Lt. Schiefer, reviewed the potential high temperature base stocks and gave the advantages and disadvantages of each one. The high temperature properties and limitations of MIL-O-5606, particularly properties affected by volatility in the 200-275 F range (Type II system). The characteristics most directly related to the base stock volatility are: (1) residual film formation; (2) vapor pressure; and (3) inflammability.

Lt. Schiefer stated that evaporation of the base stock allows polymeric additives to concentrate in the residual film, resulting in sticky or tacky conditions. Vapor pressure-temperature data, illustrated, indicated the degree of pressurization required to use this fluid in a closed system above 200 F. Pump tests indicate that viscosity of this fluid is adequate to lubricate piston pumps and maintain pump efficiency at temperatures of 300 F and probably up to 400 F. The thermal stability of MIL-O-5606 (no change in viscosity and acidity) during corrosion-oxidation tests varies from more than 10,000 hours at 100 F, to 3000 hours at 200 F, to 200 hours at 275 F, to 60 hours at 300 F. The stable life varies with rate and intensity of aeration, especially at higher temperatures. Systems pressurized with an inert gas or that use an airless reservoir system are stable at much higher temperatures.

Lt. Schiefer then discussed MIL-O-8446 (USAF)



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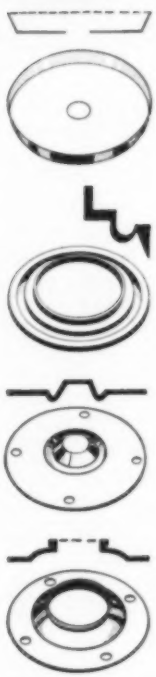

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JET AIRCRAFT SYMPOSIUM

type fluids for Type III (-65 to 400 F) systems. He reviewed the development of MLO 8200, OS-45, OS-45-1, 71852-B, 72073-C, 72173-C fluids and the blend 85/15 produced by WADC. He gave property test results on five such silicate type fluids. Lubricity studies indicate that the lubricity of these fluids are probably not as good as that of MIL-O-5606 at 160 F. These fluids, like 5606, have a longer life in a closed system. Contracts now let for the purpose of improving weak points in the MIL-O-8446 type fluid are expected to improve the hydrolytic stability of the silicate fluid through structural changes and the use of proper inhibitors.

In the 0 to 550 F temperature range (Type IV) two silicate fluids are being tested. Most test failures have resulted from seal and gasket leakage rather than fluid breakdown or adverse effects of the fluid on the pump. Taking all properties into consideration, it was decided to concentrate on silanes, chlorinated silicones, hydrocarbon and mineral oils and chlorinated biphenyls.

PROGRESS WITH SILICONES

The case for silicone fluids was ably presented by W. H. Ragborg, Dow-Corning Corporation, in his paper, "Potentialities of Silicones as High Temperature Hydraulic Fluids". Recent developments in silicone fluids for high temperature hydraulic fluid work, specially designed for lubricant applications, indicate that these new fluids may offer definite advantages. This is especially true of the silicone fluid described as chlorinated phenyl containing methylpolysiloxanes. Silicone fluids are found to be satisfactory for many types of bearing combinations: steel against zinc, cadmium, certain babbitts, berylium copper and special brasses in sliding contact. In such cases wear was equal to or less than that encountered using a petroleum lubricant.

Changes in polymer structure, blends with small and large amounts of organic additives and new organic groups have been studied. Aircraft hydraulic pump performance testing with silicone fluids has been limited. Limited tests do indicate that when the pump was operated at speeds and pressures below the manufacturer's maximum specification, satisfactory performance can be obtained.

The third paper on high temperature fluids, "Oronite High Temperature Hydraulic Fluids 8200 and 8515" by N. W. Furby and R. L. Peeler of California Research Corporation and R. I. Stirton of Oronite Chemical Company, was read by Dr. Furby. The fluid designated as MLO-8200 by WADC was developed by contract early in the high temperature fluid picture. While silicones have satisfactory physical properties, they have poor steel-on-steel lubricity. Organic silicate esters, particularly the disiloxanes, have excellent physical properties, but had been rejected in earlier work because of poor hydrolytic stability.

A program to improve hydrolytic stability and other properties was carried out. A disiloxane was

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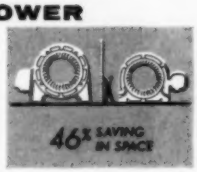
more motor than ever before...

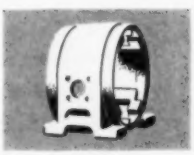
more HORSEPOWER

Type H is most compact. The same horsepower is provided in a "smaller package." An actual saving in space of 46% for the 2 h.p. size.



more RUGGED

The cast-iron frame defies distortion. The smooth cast-iron surface is highly corrosion-resistant. The heavy solid feet on the Type H are a substantial part of the frame.



more PROTECTION

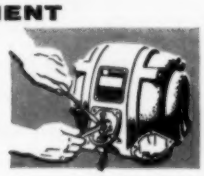
Ventrifoil directs air, deflects water. Each end of the motor has a specially formed deflector which directs air around bearing housings and into fans on the rotor.

more INSULATION

U.S. multiple protection increases insulation life. ASBESTOS—for protection against heat. SILICONE—for moisture resistance. MYLAR—for greater physical strength.

more CONVENIENT

The spacious conduit box is a heavy-duty cast-iron, diagonally split type, attractively contoured and very easy of access.



New-fashioned power is the result of more and more exclusive and valuable features present only in this new motor. They include asbestos insulation to resist heat and moisture; Lubriflush bearing construction for longest life; Ventrifoil baffles to direct air and deflect water; solid cast-iron frame and normalized castings, all directed to the objectives of longer motor life and more efficient power.

A profusely illustrated multicolor bulletin fully describing construction features of the Type H motor is available. Write for your copy today.

U.S. Electrical MOTORS

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P. O. Box 2956, Los Angeles 54, Calif., or Milford, Conn.
Send Type H Bulletin No. F-1856

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Company_____

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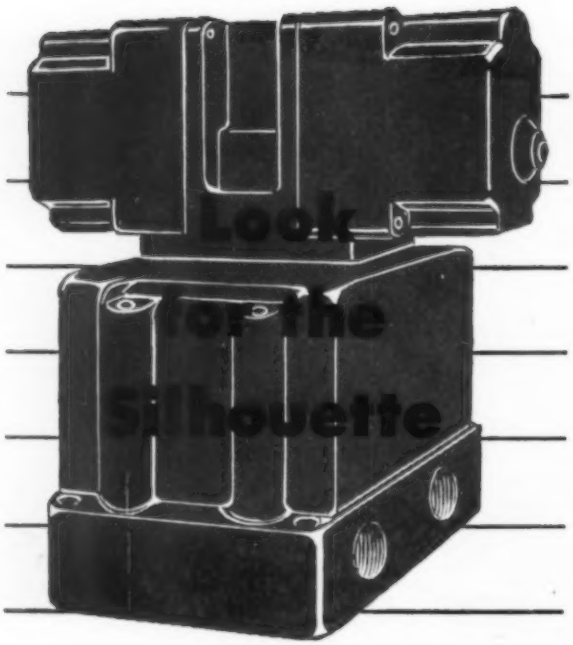

A warm welcome awaits you at Booth No. 328 during the A.S.T.E. Industrial Exposition (Tool Show) at Chicago, March 19 to 23.

Here you will receive advance information about NOPAK-MATIC... a complete new line of solenoid pilot operated, poppet-type valves to be introduced later this year. These valves are designed for a wide range of control applications from the simple operation of an air cylinder to the complex, precision operation of completely automated production machinery.

At the NOPAK Exhibit you will also find the new NOPAK Square Head Cylinders and such established products as standard NOPAK Cylinders in various classes of construction, NOPAK Disc-Type Valves, Reciprotrol Valves and V-Type Slide Valves.

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VALVES and CYLINDERS

for AIR and HYDRAULIC SERVICE

A 8739-½-VA

chosen for the base stock because its viscosity-temperature properties are markedly superior to those of an orthosilicate of the same viscosity. A very effective viscosity index improver was added. This fluid essentially met properties called for by WADC.

WADC, in their work with packings, found that the 8200 fluid did not cause sufficient swell in rubbers developed for use at 400 F. The inclusion of 15 percent diester increased swell to the desired range. The 8200 fluid has better compatibility with available rubbers at 550 F than does the 8515 fluid and for this reason is recommended for operating temperatures above 400 F.

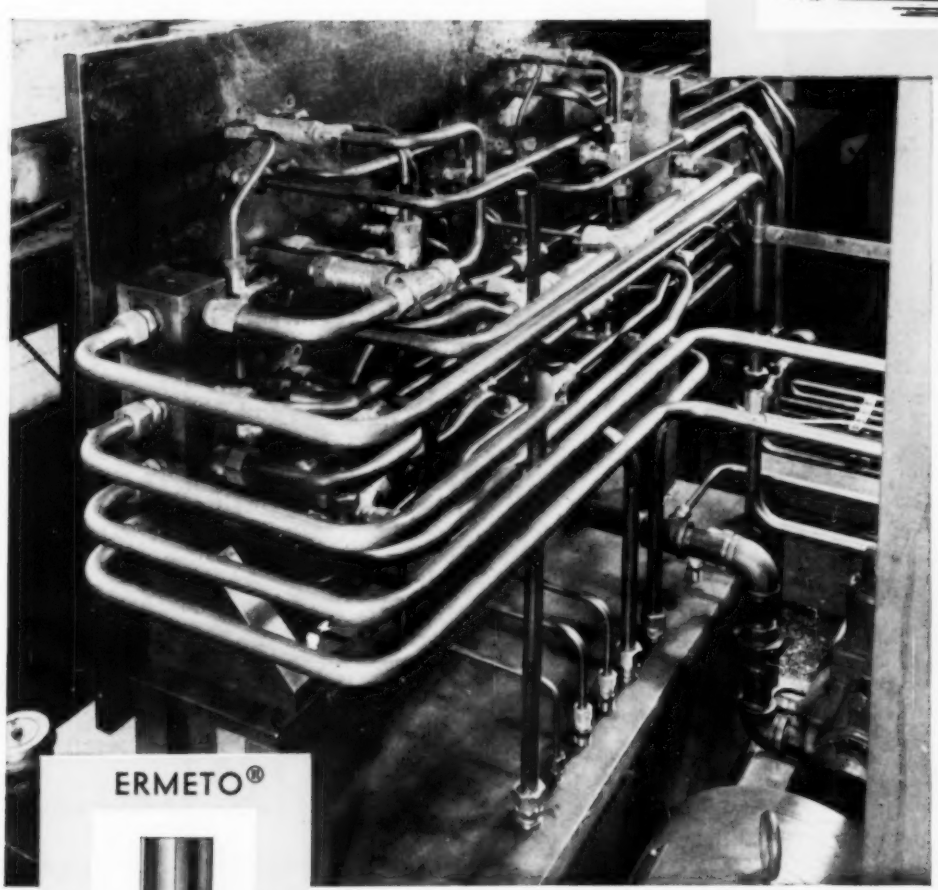
Both fluids have high viscosity at high temperature, minimizing lubrication failures due to excessively thin fluid films. Internal pump and system leakages are minimized. The fluids exhibit outstanding resistance to permanent shear breakdown; low vapor pressures, reducing evaporation and pump cavitation and materially reducing fire hazard due to flammable vapors.

AND NOW ORTHO-SILICATE ESTERS

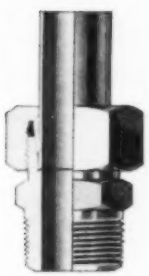
The final paper on fluids was the paper, "The Technical Appraisal and Performance of OS-45 and OS-45-1 as High Temperature Aircraft Hydraulic Fluids" by H. S. Litzsinger and R. E. Hatton, Monsanto Chemical Company, was delivered by Mr. Litzsinger. Both of these fluids are ortho-silicate esters, the first was introduced in 1951, the second in 1952. Silicate esters possess excellent thermal stability, excellent viscosity-volatility-temperature properties, passable lubricity and excellent response to additive treatment. They exhibit a low order of toxicity and are potentially available in quantity at reasonable cost. The major disadvantage is a tendency of the silicate esters to hydrolyze in the presence of water. The fluids hydrolyze to form preciptates. Such precipitates are not abrasive and service experience indicates that they are not a serious problem.

The stability of OS-45, tested at 400 F for 72 hours is exceptionally good; there was very little metal attack; acidity development was somewhat greater than allowed by the specification. Major aircraft pump companies using OS-45, have been working on two problems: to develop a pump for extended operation at a maximum of 400 F and another for limited operation, perhaps in the range of 10 hours at 550 F. High pressure pumps have operated on OS-45 for 100 hours at 400 F. Other pumps have operated for 10 hours at 550 F. No reports on deficiencies in lubrication have been made on either OS-45 or OS-45-1. While OS-45 does not have an impressive viscosity number at 400 F, numerous tests have not disclosed a lack of pumpability of the fluid up to 500 F. All three manufacturers now producing high temperature pumps have reported, with OS-45 or 45-1, volumetric efficiencies over 80 percent. ▼▼▼

When the pressure is on...



ERMETO®



When the pressure is on and positive vibration-resistant connections are a must . . . specify Weatherhead Ermeto® Connectors. Installation can be made in seconds with standard bench tools. There's no flaring . . . no threading . . . no welding . . . no soldering. The cutting and bowing action of the sleeve assures an unyielding leakproof seal . . . a joint that can be disassembled and reassembled time and time again. Write The Weatherhead Company for detailed data and application information.

For ready reference on the complete Weatherhead line, see pages 264-270 of the Master Catalog of Fluid Power Products.

WEATHERHEAD *YOUR ONLY SINGLE-SOURCE LINE of HYDRAULIC HOSE and FITTINGS*

Drain and Shutoff Cocks | Brass Tube Fittings | Selfalign | SAE 37° Flare (JIC) Fittings | Ermeto® | Bulk Hose and Reusable Hose Ends | Hose Assemblies

THE WEATHERHEAD CO., FORT WAYNE DIVISION, DEPT. A-3
128 WEST WASHINGTON BLVD., FORT WAYNE, INDIANA
In Canada: THE WEATHERHEAD CO. LTD., ST. THOMAS, ONTARIO

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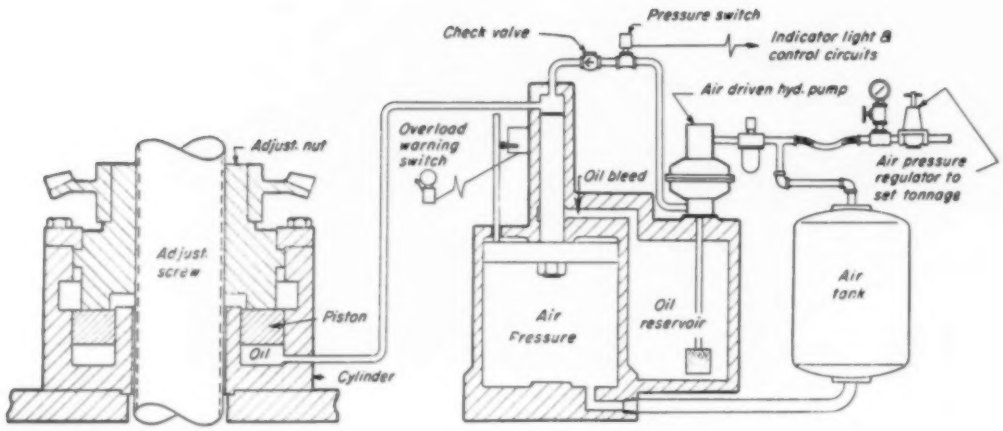
FLUID POWERED SAFETY device is used on this 1650 ton Clearing mechanical press.

TOOLING IDEA

AIR-HYDRAULIC DEVICE PROTECTS PRESS TOOLS

Overload protection on presses means less down-time due to die breakage or damage. Money spent to repair damage caused by one double hit could be much more than the cost of protection.



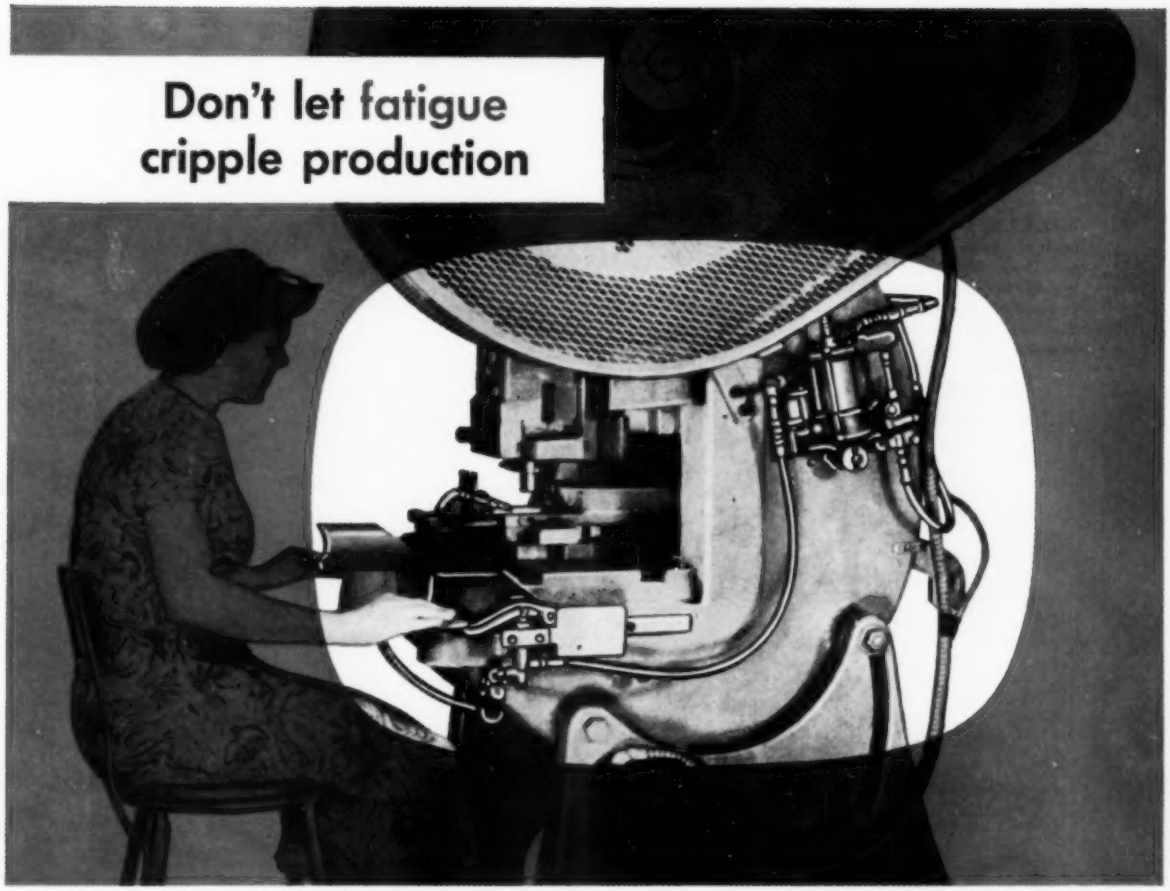
AN air driven hydraulic pump costing less than $200 supplies the hydraulic pressure which prevents completion of slide motion if there is an overload within the last ½ inch of press stroke. Although the slide will stop, because of an overload, the drive will continue through to finish the stroke. This avoids sticking of the press.

The slide adjustment nut is seated on the piston of a small hydraulic cylinder. Oil beneath the piston has only one outlet, the intensifier. Tonnage, which is determined by the load, is exerted by the slide and builds hydraulic pressure in the adjustment cylinder. If there is an overload, the pressure will be great enough to force down the piston of the intensifier. The adjustment unit will compress up to ½ inch. The tonnage at which the adjustment units will compress can be accurately preset by adjusting the air pressure in the intensifier. In most applications they are set to relieve at 30 percent overload.

A slight compression of the adjusting screw will force the intensifier piston down far enough to trip the overload warning switch, and a warning bell will ring. If the overload causes the adjusting screw to compress as much as .10 inch, the intensifier piston will have been forced to the bottom of its stroke ,and oil in the pressure circuit will begin to bleed off into the reservoir. Any further compression up to ½ inch will continue to bleed oil off. If oil has been lost, when the press begins its up stroke, the oil pressure will drop. This will trip the pressure switch, disconnecting the operating button and slide adjustment control circuits, and the indicator lights on the main control panel will change from green to red. The clutch will automatically disengage at top stroke if the red light is still on. The air driven hydraulic pump will immediately begin to replace the lost oil. When the oil pressure reaches normal, the pressure switch will close, the red light will be replaced by green, and the press will be ready to operate.

This device gives automatic protection and signals the operator to check the cause of overload before continuing production. ▼▼▼

Don't let fatigue cripple production



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INCREASE PRODUCTION, ELIMINATE FATIGUE . . . *WITH GREATER SAFETY*

Schrader Air Controls give not only greater production with less fatigue . . . but they provide greater safety all along the production line.

There is a Schrader Pneumatic Control to cover most any machine operation . . . power presses, press brakes, and any machine using either a friction or mechanical clutch. Schrader Controls promote building a high-speed work rhythm that pays big production dividends with safety. A special arrangement of valves prevents operators from tying down either of the two hand controls to defeat the purpose. Both hands must operate the valves at the same time or the press will not function.

Want more information on these and other new and improved Schrader Pneumatic Controls? Write today . . . or fill out coupon below!

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WITH LEFT HAND operator controls 4-way and 2-way valves selecting direction of the cylinder and pressure setting of the pressure compensated pump.

Converted mechanical barrel former uses a

TWO PRESSURE PUMP CONTROL

• By A. H. Snipes

THE art of barrel making is an old one, but modern methods are being applied to make "coopering" faster, easier, and more uniform. Barrel staves are held together by hoops with a force that makes the barrels waterproof. One step in the barrel-making process is forcing heavy, temporary hoops over the staves to pull them together in a waterproof joint. At Northern Cooperage Co. hydraulics has been applied to this operation, replacing the electrically-driven screw down mechanism used previously.

A. H. SNIPES, *Vice President, Northern Cooperage Co., St. Paul, Minn.*

The original machine was driven by two electric motors—one for down travel and one for return. These acted on the heavy screw through two clutches. Speed and force were fixed, and it was the judgement of the operator that determined how far and how tight the hoops were pressed on. If the hoops were too loose, the barrel leaked; if they were too tight, the staves cracked.

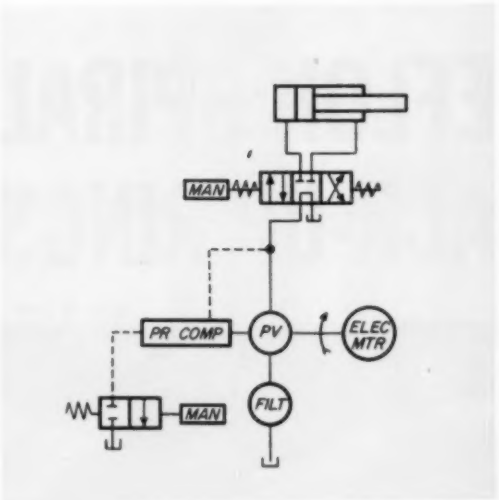
Because this was a slow process that produced non-uniform barrels, the drive was changed to a direct-acting cylinder. The middle hoops are now pressed on to a preset force, determined by the pressure setting of the pressure-compensated pump. The end hoops are pressed on at a lower pressure until the hydraulic cylinder moves against a stop.

The high pressure for driving the inner hoops and the low pressure for driving the end hoops are obtained with a governor on the pump and a 2-way valve for draining fluid from the governor. When the 2-way valve is closed, the pump reaches neutral position at the high preset pressure setting. When the valve is open to drain, the pump reaches neutral at the low preset pressure.

A 7½ hp motor is mounted with the pump on a 60-gallon tank atop the machine. The 4½-inch bore drive cylinder has a 14-inch stroke. The 4-way valve for direction control of the cylinder is mounted with the 2-way valve which controls pressure, so that they can be operated in the proper sequence with one hand. Operating and closing of the arms which engage the hoops is controlled mechanically with the other hand.

The sequence of operation is as follows:

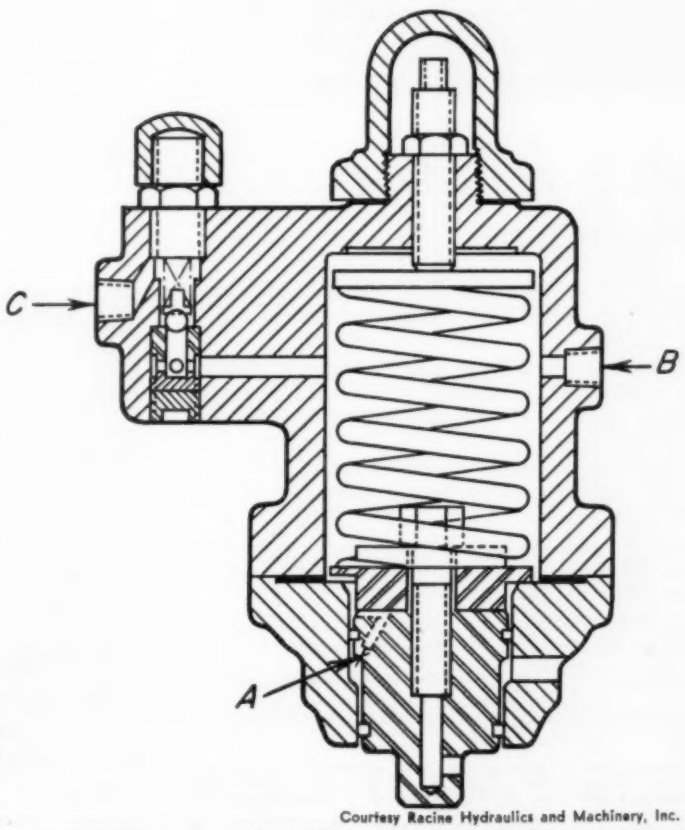
1. Operator positions barrel form with two hoops on one end. With the 2-way valve closed for high pressure, he moves the 4-way valve to extend the cylinder. The arms engage the lower hoop and press it down until the pump pressure setting is reached. At this balance,



PUMP PRESSURE is bled internally to pressure governor. Closing 2-way valve allows pressure build-up in governor producing a higher pressure at pump neutral position.

—Operation of the Pump Governor

The pressure at which the pressure-compensated vane pump reaches neutral (no delivery) position is controlled by the 2-pressure governor. Fluid from the pump chamber is introduced into the pressure governor chamber through orifice A. When port B is open to drain, no pressure develops in the chamber and the main spring determines the low pressure at which the pump reaches neutral. When port B is blocked, pressure is developed and acts to aid the spring in opposing the developed pump pressure tending to force the pump to neutral position. Thus the pump reaches neutral position at a higher pressure than when port B is open to drain. The high pressure is preset by adjusting the relief valve which drains through port C. The low-pressure is preset by adjusting main spring tension. Maximum high-pressure setting is 1000 psi. Maximum low-pressure setting is 400 psi.



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for Military Standard

TEFLON® SPIRAL BACK-UP RINGS

specify FLUOROFLEX®-T because . . .

- These rings are produced to military standard drawings MS 28782 and MS 28783 under exacting inspection controls.
- Both tube stock and machined rings are individually annealed to relieve internal strains and to assure compliance with aircraft dimensional stability requirements.
- This quality controlled method of manufacture provides rings with *all* properties *certified** to AMS 3651 specification.
- Rings are packed in protective telescopic containers on supporting mandrels to preserve shape and dimensions to facilitate installation.

Complete range of sizes for use with AN 6227, AN 6230 or MS 28784 "O" rings. Send for data.

**Photostatic copies of test reports are available upon request.*

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RESISTOFLEX
CORPORATION

ROSELAND, N. J. • WESTERN PLANT: BURBANK, CALIF.

CONVERTED BARREL FORMER

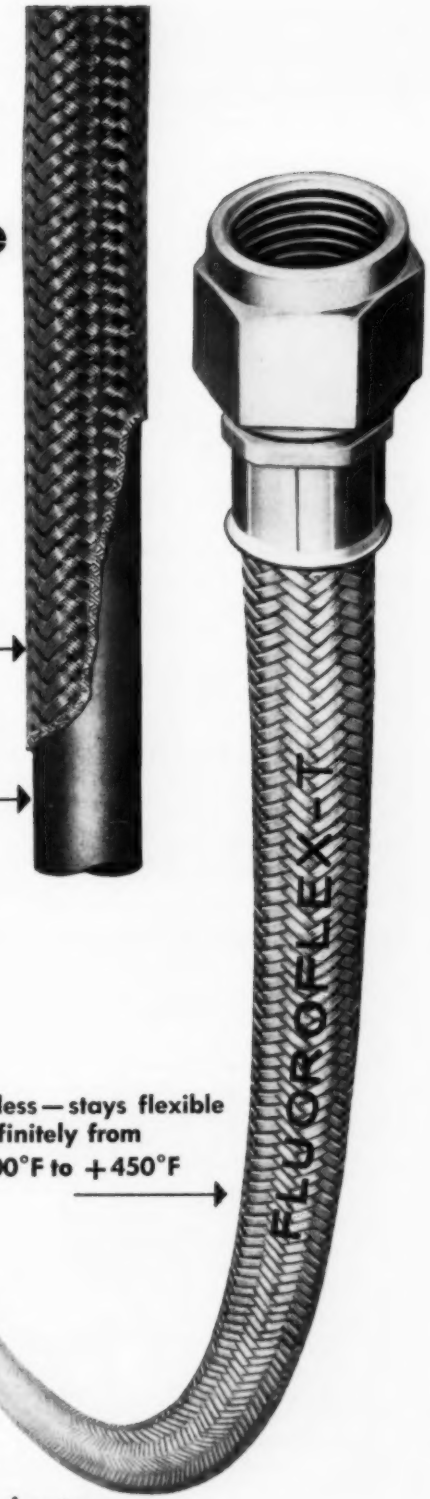
cylinder force equals the friction force of the hoop against the barrel and the pump delivery is nearly zero.

2. Operator opens the 2-way valve lowering the pressure setting of the pump. He opens the arms removing the load and the cylinder extends. A second set of shorter arms engages the upper hoop and the cylinder extends against a stop.
3. Operator then reverses the cylinder by actuating the 4-way valve and releases the 2-way valve for the next cycle. When the spring-centered valve is released, the cylinder ports are blocked and the pump unloads to tank.

ORIGINAL DRIVE required two electric motors driving a screw through clutches. This was slow and resulted in breakage and defective barrels.

HYDRAULIC CONVERSION employs a direct acting cylinder to give fast, accurate positioning of hoops. Power costs and maintenance have been considerably reduced.

This TEFLON® hose offers the ultimate in serviceability



- 1000 psi working pressures
- completely inert to all hydraulic fluids
- Ageless—stays flexible indefinitely from −100°F to +450°F

HERE'S flexible hose with the advantages of a special tube of Teflon—by the *originator* of Teflon hose.

This Fluoroflex®-T tube withstands temperature extremes. Amazing chemical inertness, smooth bore and inherent lubricity give full freedom from obstructions . . . from contamination of hydraulic fluid due to erosion. Corrosion resistant SAE 304 stainless steel wire braid reinforces for 1000 psi working pressure.

Fluoroflex-T R-3800 hose assemblies have swaged fittings that are leakproof and blowoff-proof. Over 3 years' service experience back up its superior design. These assemblies save weight and space . . . are easy to install.

Teflon hose gives the hydraulic engineer the finest hose yet to assure top circuit performance. It lengthens service life, increases reliability, lifts permissible temperature limits, withstands severe environments. Send for Bulletin FH-2.

RESISTOFLEX CORPORATION, Roseland, N.J.; Western Plant: Burbank, Calif.

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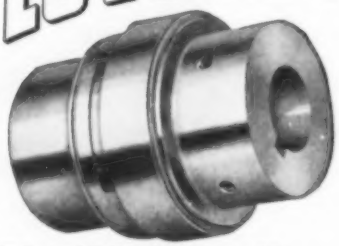
15 YEARS SERVICE WITH ONE SET OF CUSHIONS

... actual report on

LOVEJOY



Flexible Couplings

Up to fifteen years maintenance-free service is not unusual with Lovejoy lubrication-free flexible couplings.

Performance like this is practical proof of these soundly engineered features:

SIMPLE, RUGGED CONSTRUCTION
Fewer parts. No intricate mechanisms. Nothing to lubricate.

LOAD TRANSMITTED BY CUSHION COMPRESSION
No wear on the metal jaws.

DOUBLE-LIFE CUSHIONS
One half of the cushions act as idlers—except on reversible loads. A quick interchange provides a new set of cushions. This can be done without dismantling the coupling.

Illustration at right shows a Lovejoy Type CF flange-mounted coupling. Rated at 160 hp., 800 rpm., this space saver connects drive shaft between diesel power unit and generator.

You can get Lovejoy performance for your application.

Let us know your requirements or request complete-line catalog.

LOVEJOY FLEXIBLE COUPLING CO.

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Mfrs. of Flexible Couplings, Variable Speed Pulleys and Transmissions, Motor Bases and Universal Joints.

Ideas from a Sales Engineer

Elmer F. Heiser

Elmer Heiser has been selling air and hydraulic components for 19 years. During this time he has solved many problems and admits to leaving some unsolved. He is the author of the book "Air and Oil Cylinders in Industrial Applications."

Pump Life

IN a previous column the expected useful life of pumps was discussed, but the article wandered off into such subjects as spares and stand-by equipment.

An old friend came through with a bit of comparison he had worked out on the same subject, suggesting it might be useful to fill up this space some time. Incidentally, he worked in a plant for years doing engineering, until he recently slipped into an entirely different pattern of existence. Now, instead of working, he is selling fluid power equipment up around Seattle somewhere. The following information was put together before he turned to sales to make his living. Should he read this column he will probably skip down to see if his material sounds O.K. So right here it will be safe to say that after a couple of years of selling he couldn't possibly convey the same amount of information in such limited space. Did you ever notice the difference between the reply to a question asked an engineer and the same question asked a salesman? You ask an engineer, "Will this thing work?" and he may say, "Sure, why not?" The salesman starts his answer and you find yourself watching the clock to make sure you don't miss the lunch hour.

The following was prepared by George Verhaeghe, B.S. (before sales).

"The question of pump life comes up very often, yet, I am sure no two people will agree on the same answer. It is extremely difficult to make an accurate forecast; first of all, one must ascertain certain facts:

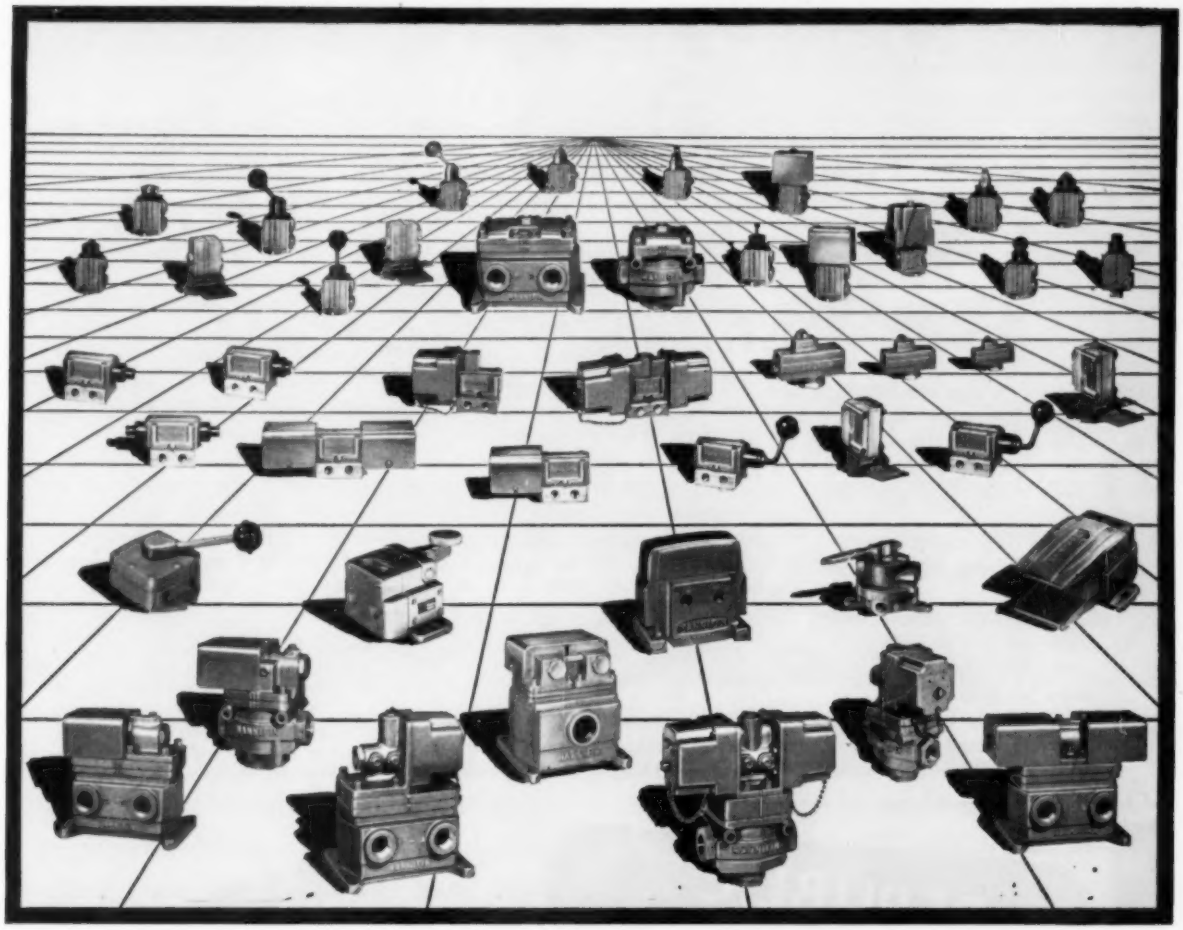
1. What is the operating pressure?
2. What type of duty cycle will be maintained?
3. Is there severe shock in the system?
4. What type of oil is used?
5. Is the unit operating in a clean or contaminating atmosphere?
6. Will the temperature in the system be properly controlled?
7. What means of oil filtration will be provided and/or how often is the oil replaced?

Assuming that answers are submitted which indicate average conditions of operations, we might venture a guess—say normal operating life should be about one year. We qualify this by saying that one year is made up of an 8 hour day, 5 days a week, 52 weeks per year or:

$$8 \times 5 \times 52 = 2080 \text{ hours}$$

If the unit is operated 16 hours per

FOR AIR CYLINDER CONTROL... Manual or Electric



Hannifin is your best valve source

What air control valves do you need, or prefer? Hannifin has all types—for your production lines or the machines you manufacture. They include:

P-M Pilot-Master Valves, solenoid controlled by integral pilot heads (including new-type, dust-tight, splashproof heads that completely meet J.I.C. recommendations). ⅜" to 1¼". 2-way, 3-way and 4-way.

P-M Master Valves. ¾" to 1¼". 2-way, 3-way and 4-way, air operated. For remote control from a wide choice of P-M Pilot Valves.

P-M Direct-Operated Valves. For direct control of small air cylinders. 2-way, 3-way and 4-way. ¼" and ⅜".

Disc Valves. Rotary and sliding reciprocating disc types for hand, foot or electric operation. ⅛" to ¾".

Micrometric Speed Control Valves for micrometer-like speed adjustment through control of exhaust flow.

You can simplify your air control problems by standardizing on Hannifin.

Stock Delivery On All Types

HANNIFIN

MAIL THE COUPON FOR PROMPT ACTION

- ☐ Have Field Engineer call at once
- ☐ Have Field Engineer stop by soon
- ☐ For the present, just send complete Hannifin Control Valves Catalog

Hannifin Corporation, 545 S. Wolf Rd., Des Plaines, Illinois

Name.....*Title*.....

Company.....

Address.....

City.....*Zone*.....*State*.....

Circle 62 on Reader Service Card

day, our 2080 hours period is covered in six months, at 24 hours per day, the 2080 hours is covered in four months. If the unit is operating 24 hours per day, 7 days a week:

$24 \times 7 \times X = 2080$
$X = 12.4$ wks. or approximately 3 months

Of course, the average user will not agree that the 2080 hrs. service is acceptable, it should last much longer under average conditions—how much longer? Well, let's look at another set of conditions; perhaps we can set up another yardstick. Let's think out loud at this point.

How long do I expect my automobile to perform without trouble?

Let's examine the facts:

1. How fast do I drive?
   Average speed let's say 45 miles per hour.
2. How often do I change oil?
   Every thousand miles—no—well at least every 2000 miles.
3. How often do I get a tune-up?
   Once or twice a year.
4. Do I drive at top speed for prolonged periods?
   Not usually.
5. Do I buy good oil, or the cheapest lubricant we can get? Usually a pretty good grade.
6. Am I careful about getting water and dirt into our oil system?
   I try to be careful, at least it's drained out frequently.
7. What happens when I operate at excessive temperatures?
   I am in for serious trouble.

O.K. let's get down to figures. Assuming I operate under average conditions, would we all agree the 90,000 miles is better than average life? O.K., on this we agree—now let's see—

90,000 miles @ 45 mph

$$\frac{90{,}000}{45} = 2000 \text{ hours}$$

2000 hours, why that is less than the pump ran, and I've had the car greased 90 times, the oil changed 45 times, tires replaced at 30,000 and at 60,000, valves ground at 45,000, new clutch at 60,000, four sets of spark plugs, 2 batteries—hmmmmmmm? Yeah!!"

That is interesting. To match the performance of many pumps an automobile would roll the speedometer from zero thru the 100,000 mark monotonously. The inferred comparison between the attention given the automobile during its' normal life and the inattention often suffered by hydraulic equipment shouldn't go unnoticed.

Some one will hurry to the conclusion that there is a vast difference between an outdoor vehicle with an internal combustion engine and a comfortably indoors mounted hydraulic pump just spinning around on a shaft. Sure there is, but if you want to argue about it, go west and look up George. ▼▼▼

Editor's note: In Cleveland traffic we do well to average 20 miles an hour. Which means that it will take us 4500 hours to drive 90,000 miles. However, after 200 hours of exposure to street salt, rust eats the body off so we'll never complete this analysis.

REPUBLIC
"LO-TORQ"
SELECTOR VALVE

0-6000 psi SERVICE with
LOW TURNING TORQUE

Exceptionally low turning torque is obtained by "floating" the valving disk in the service fluid, thereby balancing the pressure and eliminating thrust bearings . . . a sound application of the hydraulic engineering principle that fluids under pressure exert force equally in all directions.

Sealing rings on both sides of the selector disk eliminate leakage at all times whether pressure is forward, back, or off entirely.

For air and gas service, 0-2000 and 0-4000 psi; for fuel, hydraulic oil, petroleum, and water service, sizes ⅛" to 1", 0-3000 and 0-6000 psi. 2, 3, and 4-way.

Write for catalog no. 454 for complete information.

Distributors in principal cities from coast to coast.

- 0-6000 psi service
- Low turning torque
- Panel mounting
- Semi-steel, bronze, aluminum alloy
- No leakage at any time
- 3 types of portings

RM

REPUBLIC MANUFACTURING CO.

15655 BROOKPARK ROAD • CLEVELAND 11, OHIO

Circle 120 on Reader Service Card

Circle 6 ⟶

How can you afford ordinary gear type couplings when AJAX NEW 3-D Degree DIHEDRALS HANDLE 3 DEGREE MISALIGNMENT at the same low price?

With ability to handle angular and offset misalignment...with minimum backlash... with perfected lubricant sealing...with long life,—Ajax Dihedral Couplings have made ordinary couplings obsolete.

And now AJAX adds this new 3-D Self-aligning Dihedral Coupling at prices competitive with ordinary gear type couplings.

Features of the new Ajax 3-D Dihedral Coupling include:

3 degree misalignment capacity.

Load is distributed at center of teeth at the point of greatest strength.

More tooth strength is provided under misalignment than is possible with any other tooth shape.

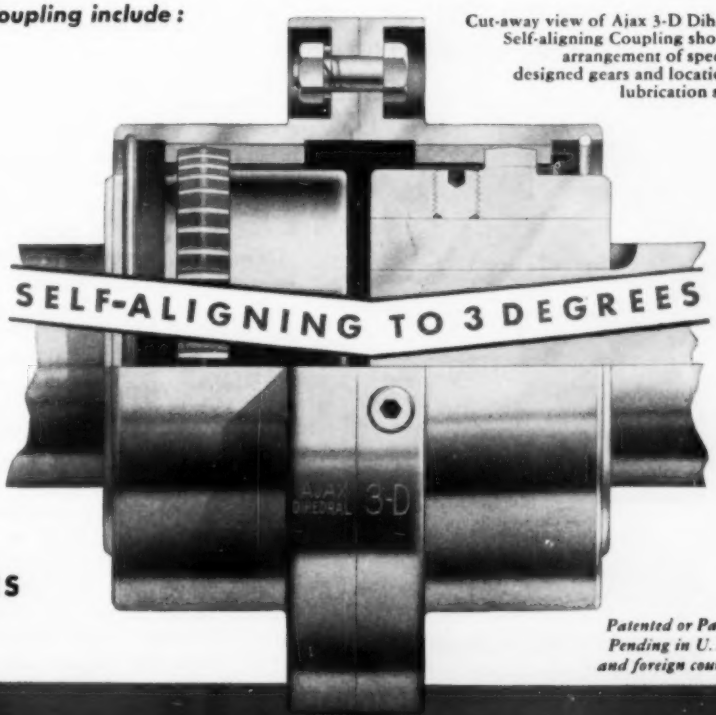
Exclusive Ajax Dihedral tooth design has less clearance than conventional gear type couplings.

No end-of-tooth wear under misalignment. Johns-Manville "Clipper" seals keep lubricant in and foreign matter out.

Compact overall size.

Designed for NEMA motors with standard keys.

Low prices competitive with ordinary gear type couplings.



Cut-away view of Ajax 3-D Dihedral Self-aligning Coupling showing arrangement of specially designed gears and location of lubrication seals.

AVAILABLE IN 5 SIZES

Write for new Catalog No. 60

Patented or Patents Pending in U. S. A. and foreign countries.

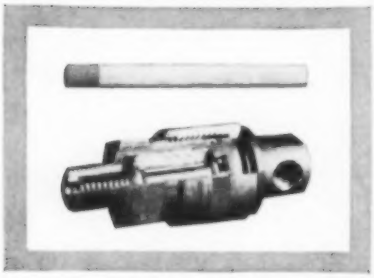
AJAX FLEXIBLE COUPLING CO. INC. WESTFIELD, N. Y.

Representatives in Principal Cities

The World's Most Complete Line of Flexible Couplings

Circle 72 on Reader Service Card

HUSCO
Hydraulic Controls are COST-SAVERS

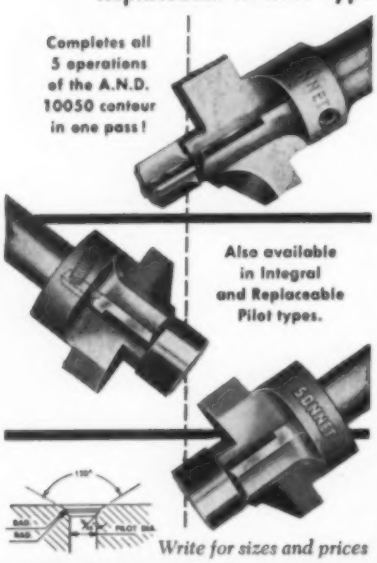


Husco No. 4000 Rotary Swivel
This low cost, high efficiency Rotary Swivel is designed for both high pressure and high operating speeds in the brake and clutch field. Compact, for use in close quarters, it has spring-loaded Teflon rings, self-centering ball thrust bearing, highly efficient axial bearings. Size, only 3" x 1⅛".

Check HUSCO *first* for experienced custom engineering in Hydraulic Controls—Valves, Cylinders, Pumps—on your new designs. Write for details.

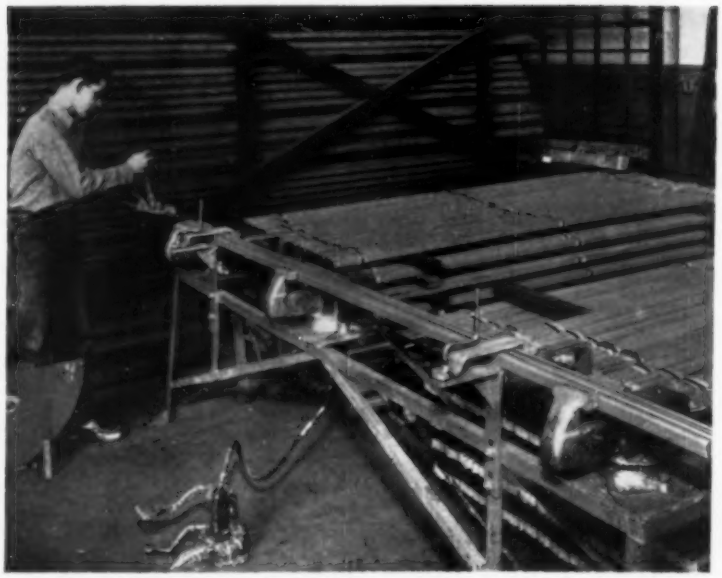
HUSCO HYDRAULIC UNIT SPECIALTIES CO.
Pumps • Valves • Cylinders
Waukesha, Wis.

Sonnet A.N.D. 10050 Port Contour Cutter
now available in a NEW Replaceable Reamer Type


Completes all 5 operations of the A.N.D. 10050 contour in one pass!
Also available in Integral and Replaceable Pilot types.
SONNET

Write for sizes and prices

SONNET TOOL and MFG. CO.
571 No. Prairie Avenue • Hawthorne, California



IF LONG STEEL bars must be bundled, a convenient method is to use three hydraulic vises, operated at one point by one man. Both hands of the operator are left free to position and wire-tie the steel bars accurately and speedily.

MULTIPLE VISE SETUP
. . . for simpler tooling

• By John E Hyler

VISES which can be operated by the foot, leaving both hands free to handle workpieces, are often hydraulic. Pressure is also released by the foot. The front jaw is the moving jaw, providing operator convenience and greatest usefulness. This type of vise is equipped with a swivel base, which can be locked at the most convenient position by a special bolt. If necessary, two or more such vises can be operated through one control by one man. Multiple vise setups are used in many instances. Since both hands of the operator are free from vise operation, awkward and heavy pieces of work can be placed by one man without difficulty. A wide range of work is advantageously handled.

In addition to the pedal with which pressure is applied to the vise jaws, a release pedal is provided for opening the jaws. No time is wasted by turning a crank or using a wrench. Operators often prefer them for these reasons, especially where both hands are needed for placing work.

Some very powerful vises are first operated by air cylinder for rapid closing. One air-hydraulic vise, made for use on milling machines, will develop clamping forces as high as 15,000 pounds, based on an operating air line pressure of 100 psi. Rated clamping pressure is 150 times operating air line pressures.

Power is obtained initially from an air cylinder which operates in combination with a special built-in hydraulic unit. The vise will operate in any position. Jaw opening may be adjusted anywhere from zero to a maximum of 5 inches, in increments of .020 inch through a positively locked adjusting nut on the hydraulic ram. Power movement of the movable jaw is .2 inch. This is ample for clamping most rough castings. This vise may be equipped with a mechanically operated air valve, for hand operation, or fitted for mechanical synchronization to machine movement. It may also be equipped with a solenoid valve, when it is desired to operate the vise electrically. ▼▼▼

FOURTH ANNUAL **APPLIED HYDRAULICS**

PRIZE PAPER

IT'S YOUR CONTEST! If you have a part in the design, fabrication, operation or maintenance of hydraulic or pneumatic components, circuits or systems for industrial or mobile equipment, including aircraft structures, you are eligible to enter the APPLIED HYDRAULICS Prize Paper Contest.

■ This established national Contest has attracted nearly 150 entries and paid off for more than 25 contestants. In addition to cash prizes, all papers published are paid for at attractive rates.

■ The decision is yours. With an Entry Blank will come Rules of the Contest and Suggestions to Contestants. The suggestions, contributed by judges in previous contests, will help keep you "on the ball."

MAKE THIS YOUR YEAR TO WIN.

As in past years:
First Prize is $500.00
Second Prize is $300.00
Third Prize is $200.00
Fourth to Seventh prizes each, ...$ 50.00

CONTEST CLOSING DATE—JULY 1st

ASK TODAY FOR YOUR ENTRY BLANK.

APPLIED HYDRAULICS

1240 Ontario Street • Cleveland 13, Ohio

Guarantee TOP Performance and Maximum Life!

Specify THESE TOP QUALITY FEATURES...

(Standard on Miller Cylinders at no extra cost)

Specify CASE HARDENED CHROME PLATED PISTON RODS
On all Air and Hydraulic Cylinders

Benefits To You

CASE-HARDENED Piston Rods (52-54 Rockwell "C") provide practically complete protection against damage from hammer blows, wrench-dropping, mishandling, and similar occurrences. ***Available from Miller at no extra cost.***

The HARD CHROME PLATING over the case-hardened rods protects against scratch-damage and rust. ***Available from Miller at no extra cost.***

Specify "TEFLON" WIPERS
On all Air and Hydraulic Cylinders

Benefits To You

"TEFLON" Rod Wipers and "TEFLON" Hydraulic Piston Rod Seals withstand temperatures from—100°F. to plus 500°F. They are impervious to practically all known chemicals, including the fire-resistant, special, and standard hydraulic fluids in current use. ***Available from Miller at no extra cost.***

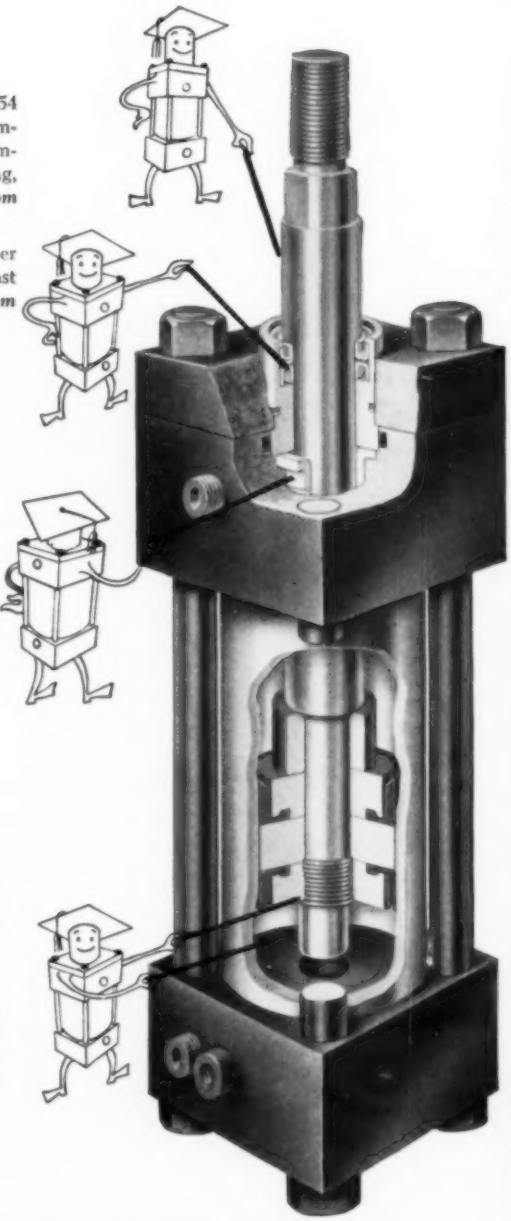
Specify TEFLON HYDRAULIC ROD SEALS
On all Hydraulic Cylinders

Specify RUST RESISTANT SURFACES
On all Air and Hydraulic Cylinders

Benefits To You

Highest quality Black Ferric Oxide Finish provides rust protection in air cylinder operation and on all cylinders during shipping and installation.

Cylinder heads, caps, mountings, pistons, followers, tie rods, and the unplated portions of the piston rods have this finish ***at no extra cost on all Miller cylinders.*** (This finish not recommended for water service)



You may wish to route this entire page to the proper department in your company, by using this handy form. Additional copies on request. →

To (Dept.)_____

"On all our future cylinder requirements, please specify the above quality features."

Signed_____

Title_____

See These New Features on Miller Cylinders at Miller

BOOTH # 429

A. S. T. E. SHOW, March 19-23
International Amphitheatre, Chicago

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Miller

MILLER FLUID POWER CO.

2008 N. Hawthorne Ave. Melrose Park, Ill.

AIR & HYDRAULIC CYLINDERS • BOOSTERS • ACCUMULATORS
COUNTERBALANCE CYLINDERS

New Products continued

PART-WINDING MOTOR
. . . for 2 or 3-step starting

Features: Motor combined with magnetic increment starter reduces starting shock to machines, minimizes line disturbances, and limits inrush current.

Operation: For 2-step starting, half of motor's winding is energized across line as first magnetic contactor closes. At the end of timed cycle, second contactor closes to bring in second half of winding in parallel with the first. In 3-step starting, motor starts with reduced voltage on first winding, accelerates as full voltage is added to the first winding, then reaches rated speed as the second winding is brought in at full voltage.

Howell Electric Motors Co.
Howell, Michigan

Circle 176 on Reader Service Card

AIR CYLINDERS
. . . double, single acting

Designation: han-d-air

Features: Cylinders of 1, 2, 3, and 4-inch strokes are offered in double-acting and single-acting, spring-return models. Equipped for simple, universal mounting, they may be front or side-mounted, front or rear flange mounted, or front pivot mounted. The 5/16-inch piston rod is threaded for easy coupling to work loads. Bore diameter is 1 inch. Compactness and mounting flexibility of cylinders make them well suited for all types of clamping, parts positioning, and ejecting, as well as light-duty tool and work feeding operations.

The Bellows Co.
Akron, Ohio

Circle 177 on Reader Service Card

3-WAY VALVES
. . . have operating range 0-5000 psi

Designation: Model 31

Features: These solenoid operated valves for continuous duty operation feature a low current drain, fast action and are explosion proof.

Applications: For use in aircraft, missiles, test programs and industrial operations.

Specifications: Available in tube sizes from ¼ to ½ inches. Temperature range from −65 to +275 degrees F and flow rates up to 10 gpm. A wide variety of configuration can be supplied. These valves are available for shipment within 24 hours.

Mar Vista Engineering Co.
Los Angeles, Calif.

Circle 178 on Reader Service Card

FIRE RESISTANT FLUID
. . . in 6 viscosities

Designation: Cellulube Series

Features: Straight phosphate ester fluids are now available in viscosity ranges of 90, 150, 220, 300,

Continued on next page

Circle 70 on Reader Service Card

Backed by more than a century's experience

BRITISH

Hydraulic Plant & Equipment LEAD THE WORLD

Particulars of Members and their Products will appear in a future announcement.

The Hydraulic Association of Great Britain

•

94/98 Petty France, London, S.W.1. England
Telephone: Abbey 1845.

•

Cables: Crusade, Sowest, London

HAND HYDRAULIC PUMP

Single and Double Designs to 20,000 PSI
With or Without Reservoir
Standard Reservoirs
70- 160- 910-Cu. In. Capacity
Interchangeable Pistons
⅜ - ½ - ¾ Inch
1-inch Piston (Special)
Pipe connections ¼" N.P.T.
Handle length is 18 inches.

"We specialize in hand pump units to operate in temperatures from minus 65 F to plus 160 F and with any capacity reservoirs required."
The single pump with ½" or ¾" piston now available in stainless steel.

WILLIAM S. PINE
1635 E. 22nd St., Los Angeles 11, Calif.

← Circle 98

New Products continued

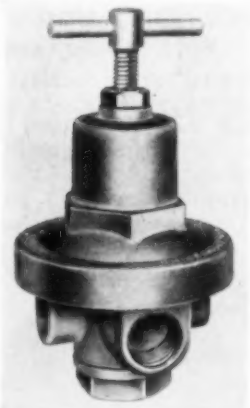
500, and 1000 SUS seconds at 100 degrees F. Fluids are recommended as replacements for flammable petroleum oil products, in die-casting, metal forming and allied industries where fire-resistance is a significant safety factor.

Celanese Corp. of America
New York, New York
Circle 179 on Reader Service Card

AIR PRESSURE REGULATOR
. . . with relief valve

Features: Regulator reduces line pressures up to 400 psi to required working pressures. If temperature rise or other cause increases outlet pressure, built-in relief valve automatically reduces pressure down to original setting. Excess pressure is vented to atmosphere through hole in bonnet. Outlet pressure can be adjusted up or down at any time without bleeding outlet side of line.

Application: Regulator is generally used on dead-end service to instruments, cylinders, etc. where a

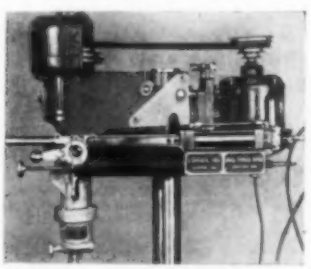


pressure build-up would seriously affect operation, or where downward pressure regulation is required during operation. Units are available for pipe sizes from ⅛ to ½ inch in 2-port and 4-port designs.

Generant Engineering Co.
Newark, N. J.
Circle 180 on Reader Service Card

DRILL PRESS FEED
. . . permits electric sequencing

Design: Air cylinder with built-in control valve drives drill press through rack and pinion. Pre-selec-



ted speed is provided with hydraulic check to control work stroke and lessen drill breakage at the breakthrough point. An impulse switch permits complete electrical sequencing with other equipment such as rotary tables. Models are available with 2 or 3-inch bore air motors and provide full 360-degree pinion shaft rotation with 3⅜ drill press stroke on most presses.

Lehigh, Inc.
Easton, Pa.
Circle 181 on Reader Service Card

Continued on page 142

JOY
1924 SURGEPRUF 1951
HYDRAULIC HOSE AND RE-USABLE COUPLINGS

3 Big Advantages for Your Hydraulic Assemblies

PERMITS THE USE OF MORE ABRASION-RESISTANT, RUBBER-COVERED HOSE

Insure longer wear in your hydraulic hose assemblies —and at the same time, save assembly time by avoiding old-fashioned skiving. Joy Surgepruf re-usable couplings make *both* advantages possible. Their exclusive "double-wedge" grip lets you use tough, abrasion-resistant, rubber-covered hose instead of the braided type—without any need for skiving the hose at the connection.

NO SPECIAL ASSEMBLY TOOLS REQUIRED

You need no mandrels or other special tools to make up Surgepruf assemblies. No extra expense or special technique is involved.

CAN BE RETIGHTENED WHEN LOOSE ON THE HOSE

Machine vibration or hose flexing can loosen any hydraulic coupling on the hose in time, but Surgepruf Couplings can be easily, quickly retightened on the job to stop a leak—*another* exclusive feature.

Surgepruf Hose Couplings are made to JIC Standards. Assemblies are available in many sizes and lengths, and in both single and double-wire reinforced types for medium-high and high pressure service respectively.

Joy Manufacturing Company, Oliver Building, Pittsburgh 22, Pa.

Get complete data on Surgepruf:
WRITE FOR BULLETIN H-100b
Consult a Joy Engineer

W&D H5514

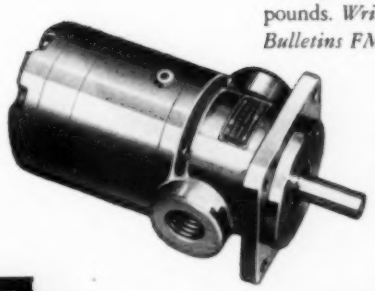
JOY
HYDRAULIC ASSEMBLIES THAT GIVE YOU MAXIMUM RELIABILITY

AXIAL PISTON PUMPS

for circuits to 3000 and 5000 psi. Up to 35 gpm. Fixed or variable stroke. *Write for Bulletins P-4, P-4-10.*

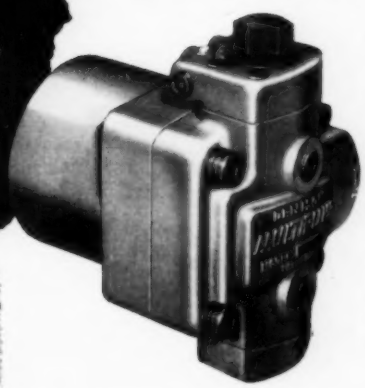
AXIAL PISTON MOTORS

for circuits to 2500 and 5000 psi. Up to 180 hp, 5665 inch-pounds. *Write for Bulletins FM-2, FM-3A.*



Hydraulic power up to 5000 psi by DENISON

VARIABLE VOLUME VANE PUMP



delivers variable volume at constant speed, constant volume at variable speed—hand-dial control—pressure compensated for circuits up to 1000 psi continuous. 3 Standard Sizes up to 5 gpm, 15 gpm, 25 gpm at 1200 rpm. *Write for Bulletin P-7.*

CONTROL VALVES

Pressure Controls, pilot-operated, (Relief, Sequence, Unloading and Pressure-Reducing Valves), ¾", 1¼" and 1½", 5000 psi. *Bulletin VR-2C.*

Relief Valves, pilot-operated, ½", ¾", 1¼" and 1½", 2000 psi. *Bulletins No. 152, VR-3.*

Directional Controls, ⅛", ¾" and 1½", 3000 and 5000 psi.

4-way, manual, mechanical, electric or pilot-controlled, ¾", 3000 psi. *Bulletin VD-2-A.* ¾" and 1½", 5000 psi. *Bulletins VD-1-A, VD-1-2, VD-4, VD-4-1.*

4-way, ⅛" and ¾", 3000 psi.
⅛" solenoid-controlled. *Bulletin VD-8.*
¾" pilot-operated and solenoid-controlled. *Bulletin VD-7.*

Surge Damping Valves, ¼", ⅜", ½", ⅝" and 1", 5000 psi. *Bulletin VS-1-A.*

Multi-Range Flow Controls, ¼", ⅜" and ¾", 3000 psi. *Bulletins No. 143-A, VFC-1-A, VFC-2-A.*

Direct-operating Controls, (Sequence, Unloading and Counterbalance valves), ½", ¾", 1¼" and 1½", 2000 psi. *Bulletins VRD-2 through VRD-8.*

Check Valves, pilot-operated, ½", ¾", 1¼" and 1½", 3000 psi. *Bulletins VPC-1, VPC-2.*

WRITE FOR BULLETINS LISTED ON THIS PAGE

to get detailed information on any of the components. For a summary of information on all Denison pumps, pumping units, motors, pump/motors and controls, ask for Bulletin 146B. Write to:

THE DENISON ENGINEERING COMPANY
1166 Dublin Road • Columbus 16, Ohio

DENISON HydrOILics

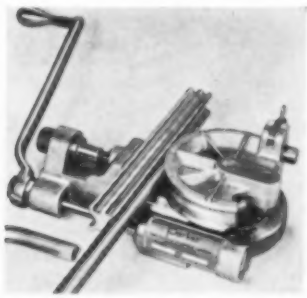
HYDRAULIC PRESSES
PUMPS • MOTORS • CONTROLS

New Products continued

TUBE BENDER
. . . has crank-operated gear

Designation: Exactol

Design: Bender is compact device for manual bending to exact tolerances, and will handle annealed or



⅛H cold drawn stainless steel tubing. Unit is designed to enable operator to make bends up to 180 degrees in one continuous smooth operation without strain or fatigue.

Construction: Worm wheel drive is enclosed for safety and protection from external damage, and disengages readily to allow quick return of the radius block after bending without being returned through the gear train. Slide block furnished with bender has grooves for tube sizes of ¼, 5/16, ⅜, ½, and ¾ inch outside diameters. Each radius block has graduated marking to indicate degree of bend, and integral arrangement for easy, quick clamping of the tube.

Parker Appliance Co.
Cleveland, Ohio

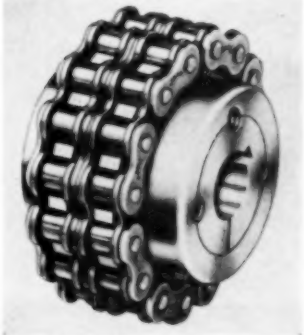
Circle 182 on Reader Service Card

CHAIN COUPLINGS
. . . with double-width chain

Designation: Taper-Lock

Features: Couplings are flexible type and permit sufficient relative movement between hubs to accommodate slight angular and parallel shaft misalignment. Special bushings make easy installation on full size or normally undersized shafts and give the equivalent of a shrunk-on fit.

Construction: Double-width chain has larger bearing area permitting higher horsepower ratings and longer life. Quick disconnecting of the shafts is possible by removing one coupling pin and unwrapping chain from hubs. Sprocket teeth are accurately cut and hardened. Two more teeth are furnished in each flange than ordinary adding to life and power-transmitting capacity.

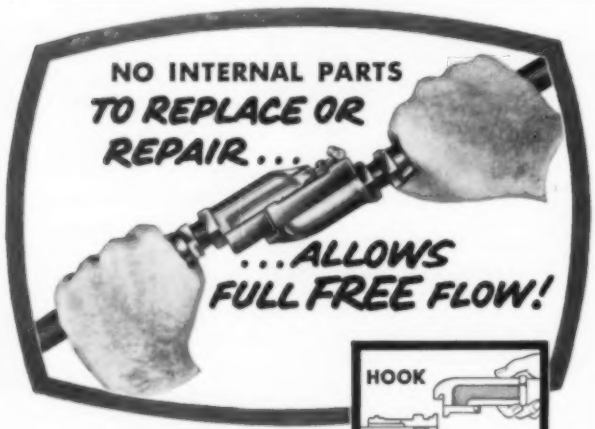


Dodge Mfg. Corp.
Mishawaka, Indiana

Circle 183 on Reader Service Card

AIR MUFFLER
. . . for air cylinder exhaust

Construction: Muffler is made of



Char-Lynn Hydra-Seal Hose Coupler

Low pressure drop in coupler allows full power for work.

Absence of internal parts assures least pressure drop of any coupler and eliminates cleaning problems. Designed and engineered as a quick-connect, self-sealing, break-away coupler for all fluid carrying lines.

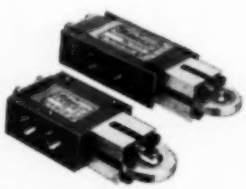
Write for free catalog and further information.

CHAR-LYNN CO.
2843 26th Ave. So., Dept. AH-3, Minneapolis 6, Minn.
Member—National Fluid Power Association

Circle 30 on Reader Service Card

Modernair

CRV SERIES ROLLER CAM VALVES



NEW Compact, Easy-Mounting Design!

FLAT SURFACES ALL AROUND, with convenient access to ports (all ⅛-27 NPT) make new CRV series valves easiest to "design into" your application. Ultra-compact—4-way is only 3/4" x 1-1/2" x 4-3/16" overall (roller cam extended).

STANDARD "O" RING SEALS throughout assure long, reliable service, are easily replaced when necessary.

CRV SERIES VALVES now available in 3 or 4-way hand lever, palm button, foot control, cam, roller or pilot-operated types. Prices range from $11.30 to $15.95, f.o.b. factory.

NO OTHER VALVE offers all these important features—why settle for less? Call your MODERNAIR dealer or write today for complete data.

Modernair CORPORATION
Trademark
Dept. B-3, 400 PREDA ST., SAN LEANDRO, CALIF.
Member National Fluid Power Association

Circle 100 on Reader Service Card

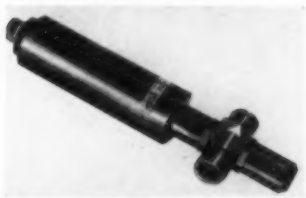
non-corrosive materials throughout and consists of a series of perforated discs held between spacers in a compact cylinder approximately 1 inch in diameter. Body is tapped for ⅜-inch female thread and standard brass hex nipples are supplied for either ¼ or ⅜-inch male fittings. Exhaust noise is reduced well below usual plant background noise level, and annoying air blast is dissipated.

Modernair Corp.
San Leandro, Calif.

Circle 184 on Reader Service Card

FLOW CONTROL VALVE
. . . is motor operated

Features: Precision valve is for pressures to 3000 psi and provides good flow control over a range from .00006 to 50 gpm. Required turning torque varies from 1 to 5 lbs and is provided by the miniature motor incorporated in the valve.



Construction: Unit consists of a metering valve, switch housing, electric motor, and electric connector. Sliding spool valve is stroked by threaded stem which rotates in ball bearing and is sealed with O-ring. Limit switches at both ends of the stroke can be used to shorten the stroke of the spool. Valve requires 10 turns for complete stroke and motor gear box combinations providing 300:5 rpm reductions are available.

United Hydraulics, Inc.
Dayton, Ohio

Circle 185 on Reader Service Card

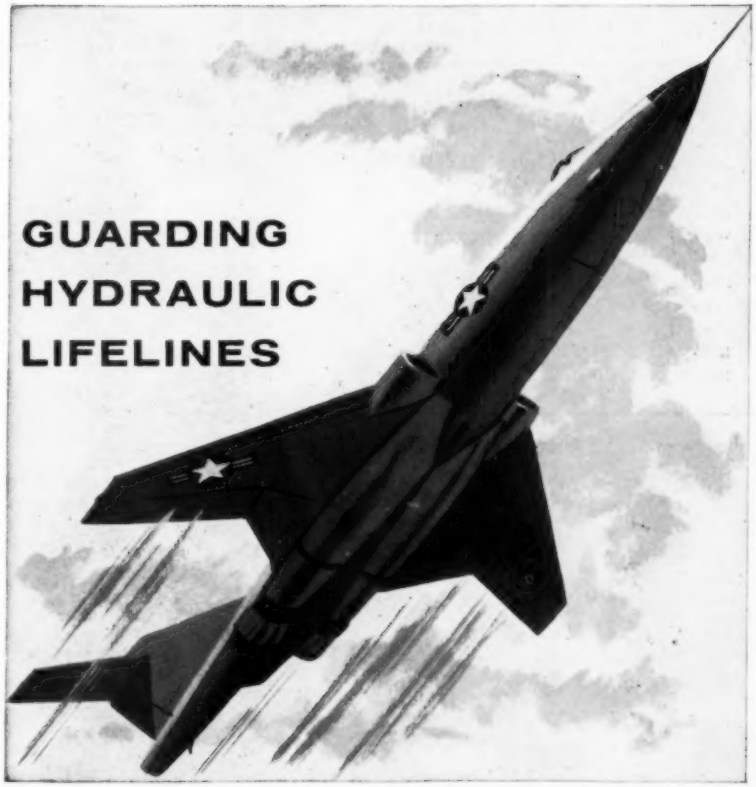
AIR, OIL CYLINDER
. . . for high production

Designation: Ultra-mation

Features: Double-acting, square-end cylinders are made in five bore sizes from 2 to 6 inches for pressures to 150 psi air and 500 psi oil. Five mounting styles are foot, trunnion, flange, clevis, pivot—with interchangeable covers permitting multiple mounting combinations.

Construction: Piston rods are extra-heavy to carry high impact

Continued on next page



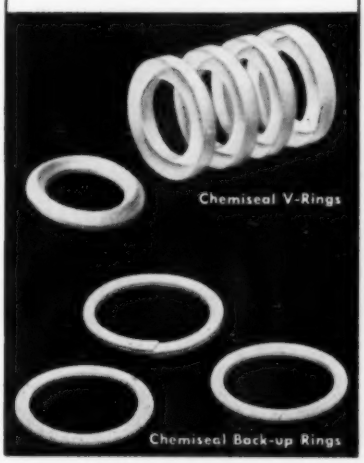
Chemiseal Hydraulic Packings

Made of duPont TEFLON—Chemiseal hydraulic packings have zero swelling in all hydrocarbons, new synthetic hydraulic fluids and solvents. Unsurpassed in anti-friction properties, tough, resilient, non-flammable, long wearing, chemically impervious. Service temperature range from minus 110°F to plus 500°F.

Chemiseal V-type packings seal with low gland pressure and operating torque. Ideal for either manual or automatically operated valves. Square-end TEFLON adaptors are available if required. Catalog TP-1255.

Chemiseal back-up rings greatly extend "O" ring life and prevent extrusion. Available in solid, split and spiral types in all commercial and AN sizes.

made of
duPont TEFLON



U.S.G. BELMONT

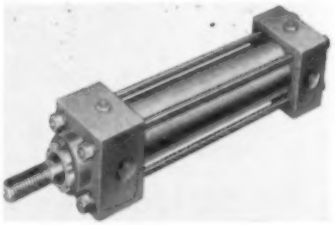
UNITED STATES GASKET COMPANY

Camden 1, New Jersey

Circle 152 on Reader Service Card

New Products continued

loads and have highly polished surfaces to assure minimum friction and maximum packing life. Rod wipers are of durable synthetic rubber assuring dirt-free rod on instroke. Cylinder tubes are hard-drawn and corrosion resistant for low friction. Tie rods are extra-heavy to resist shock loads and to maintain proper tension on cover gaskets. Cushioning is available for either or both cylinder ends as specified. Cushioned or non-cushioned cylinders have same mounting dimensions.



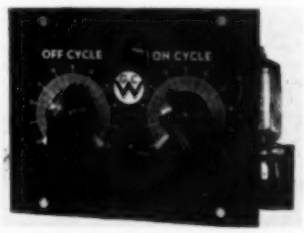
Logansport Machine Co.
Logansport, Indiana

Circle 186 on Reader Service Card

ELECTRONIC TIMER
. . . for two sequenced intervals

Designation: Model 4

Features: Timer provides two adjustable timed intervals in sequence. Operation is continuous after application of power. Unit has two miniature cold-cathode gas triodes. No filament power is consumed and



no warm-up time is required. The only moving part is a simple electro magnetic relay.

Specifications: Timed intervals are: On—0.1 to 12 seconds; Off—0.1 to 12 seconds. Output relay is single pole, double throw with 5-ampere contacts. Power supply required is 105 to 125 volts, 25 to 400 cycles, 2 watts.

G. C. Wilson & Co.
Huntington, W. Va.

Circle 187 on Reader Service Card

DIAPHRAGM VALVE
. . . of stainless steel

Designation: Bantam No. 2038

Design: Valve has special flange facing for ASA raised face flange.

Continued on page 146

ready-made to your specifications

GAR HYDRAULIC RESTRICTORS

Whatever your restrictor requirements, chances are Gar already has units with the characteristics you're after. Gar hydraulic and pneumatic restrictors come in one-way and two-way types, and just about every other type, size and rating you can imagine. But, should you ever ask for special characteristics in pressure, flow, weight, temperature or envelope size that aren't standard at Gar, you'll never know, because we'll produce what you need in the same short delivery time, at the same low price.

Some extras that might interest you, too, for special applications are self-cleaning designs that work, and electroformed orifices that are unique for highest precision and absolutely identical flow characteristics.

But right now, the important thing is to call Gar. After that, you can leave the rest up to us.

RESTRICTORS ★ REDUCING VALVES ★ RELIEF VALVES ★ FILTERS ★ SNUBBERS

To cover a full range of temperatures, pressures, sizes

Send today for full information **GAR PRECISION PARTS, INC.**
3 LUDLOW STREET, STAMFORD, CONNECTICUT

Circle 24 on Reader Service Card

STOP THAT NOISE!

— from intake and exhaust of air, steam and other gases discharged from engines, blowers, compressors, vacuum pumps, steam or gas turbines. Burgess-Manning Snubbers are engineered to your requirements for *quiet operation and greater efficiency*. Available with added features for spark arresting—air cleaning—water separating — heat recovery — or surge control.

Ask for literature.

with BURGESS-MANNING SNUBBERS

STOP THAT PULSATION!

Drop pipe-line maintenance and service costs sharply — improve flow control and operating efficiency of your equipment by eliminating vibration caused by line surges from compressors, pumps and blowers. In new layouts eliminate cost of special and extra heavy supports to secure piping from vibration.

Write for Burgess-Manning Pulsation Snubber literature.

BURGESS-MANNING COMPANY

Sound Engineering 769 East Park Avenue, Libertyville, Illinois

Dallas, Texas

Improve Air Circuit Power by Replacing Compressors with a

Get higher operating pressures and better control and efficiency in your air circuits by converting to hydraulic power. You need replace only the compressor as most air controls need no alteration.

The new Rosaen PT-10 power unit will deliver up to 12 GPM at 500 psi to give your present system all the advantages of hydraulic power. The PT-10 is a remarkably low priced unit. Your choice of ½, ¾, or 1 hp electric motors with vane-type pump and differential-type relief valve, mounted on a JIC 10-gallon reservoir, ready to operate. Write for more information.

Attention Dealers—write us for more information.

The ROSAEN COMPANY

P.O. BOX 195 • ST. CLAIR SHORES, MICHIGAN

Circle 127 on Reader Service Card

This Adams CYCLONE Saves You MONEY!

The Aftercooler and Separator that assures

DRIER Compressed Air

Here's real teamwork! First, the Adams Aftercooler brings the compressed air temperature down — within 10 of the cooling water — where it holds almost 40% less moisture than air from conventional units.

Then, the Adams Separator creates a cyclone to efficiently remove the condensate . . . giving you cooler, drier air for your system.

Thousands in use throughout industry. It will pay you to find out all the details. Mail the coupon below today.

R. P. ADAMS CO., Inc.

Buffalo 17, New York

M-56

R. P. ADAMS CO., INC.
249 East Park Drive
Buffalo 17, N. Y.

Please send my FREE copy of Bulletin #711 on Adams Cyclone Separators and Aftercoolers.

Name ..... Firm .....

Street ..... City ..... State .....

Circle 2 on Reader Service Card

New Products continued

Teflon seating is used with extra Teflon packing above bellows. Body and bonnet assembly are of stainless steel.

Specifications: Bellows is rated at 500 psi from —70 degrees F to +700 degrees F. Air cooling fins or extended neck bonnets may be supplied as well as angle or offset types with various welding, screwed, or flanged ends.

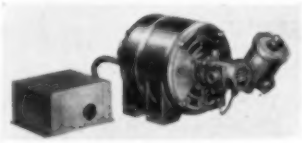
George W. Dahl Co.
Bristol, R. I.

Circle 188 on Reader Service Card

PRESSURE-VACUUM COMBINATION

. . . 400 cu. in. capacity

Designation: RG-15180



Design: Pressure pump is oil-free, positive displacement, rotary vane type. Blades are self-lubricating, carbon-graphite composition. No seals or shaft packing is used. Blades and rotor are the only moving parts and there is no gumming or sticking. Vacuum pump, mounted on front of motor is equipped with oiler that muffles exhaust.

Specifications: Pressure pump has 400 cu. in. capacity at 30 psi discharge pressure. Motor is ¼ hp. and operates at 3450 rpm, 110 volts, 50/60 cycles.

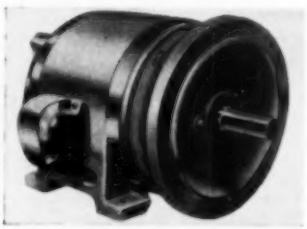
Lear, Inc.
Lear-Romec Div.
Elyria, Ohio

Circle 189 on Reader Service Card

ELECTRIC MOTORS

. . . with face mounting brackets

Design: Two styles of brackets permit bolting from driven machine or from motor side. Brackets provide automatic alignment. Motors include deflectors to direct air



and deflect water. Integrally cast one-piece frame is heat-treated to prevent warpage. Windings are asbestos-protected. Split-type conduit box may be located on either side of monamically balanced.

U. S. Electrical Motors, Inc.
Los Angeles, Calif.

Circle 190 on Reader Service Card

PORTABLE COMPRESSOR

. . . delivers 210 cfm

Designation: Blue Brute Line

Features: Rotary compressor completes line of portable units which feature a newly designed clutch and separate oil reservoir equipped with a pre-heater to assure cold weather starting. General maintenance and inspection of parts have been simplified by easy accessibility features. Gravity-draining design of the cylinders prevents "lock" and the danger of oil accumulation. Small, light unit has extremely high and rugged operating efficiency. All types of standard mountings are available.

Worthington Corp.
Harrison, N. J.

Circle 191 on Reader Service Card

Continued on page 148

"FULFLO" VALVES

By-pass, oil-relief piston type hydraulic

NO TRICK AT ALL . . .

Just select from 5 springs, install and your FULFLO VALVE is ready to go to work . . . TO MAINTAIN CONSTANT, UNIFORM PRESSURE . . . from #0 to 500#.

Standard and Flange models

NON-CHATTERING, TOO . . . because the cylindrical piston closes off the port in a shearing manner.

FOR . . . machine tool hydraulic mechanism, oil-burning equipment, rams, presses and Diesel engines. Pipe sizes: ¼" to 2"

WRITE—on your letterhead, please, for personal copy of FULFLO MECHANICAL DATA BOOK

Specify if for Valves, for Pumps or for both.

FULFLO

THE FULFLO SPECIALTIES CO. Inc.
PUMP AND VALVE MANUFACTURERS
BLANCHESTER, OHIO

WE'RE CROWING ABOUT OUR HYDRAULIC CYLINDERS - CUSTOM BUILT AT MASS PROD. PRICES

SAVE 50%

Our 10 Years of experience filling the needs of Aircraft and Heavy Industry have led to the development of these outstanding Industrial Hydraulic Cylinders. All are Double Action with rugged steel construction throughout. Made to stand pressure up to 1500 PSI and 3000 PSI. Utilizing standard 'O' rings with leather back-up rings on 3000 PSI types. Male clevis mounts on both ends of the Cylinder. Write us Today for further information. We also Custom Manufacture to YOUR SPECIFICATIONS.

PART NO.	BORE	SHAFT	STROKE	LENGTH	Type of CAP	P.S.I.	THRUST	PRICE
P3-4-15E 3	3"	1-1/8"	4	9¾"	External	1500	10,500 LBS.	$34.25
P3-6-15E	3"	1-1/8"	6"	11¾"	"	1500	"	36.75
P3-8-15E	3"	1-1/8"	8"	13¾"	"	1500	"	39.50
P3-12-15E	3"	1-1/8"	12"	17¾"	"	1500	"	44.75
P4-5-15E	4"	1-1/8"	5"	10½"	"	1500	18,750 LBS.	39.50
P4-6-15E	4"	1-1/8"	6"	11¾"	"	1500	"	41.50
P4-8-15E	4"	1-1/8"	8"	13¾"	"	1500	"	45.75
P4-10-15E	4"	1-1/8"	10"	15¾"	"	1500	"	50.00
P4-12-15E	4"	1-1/8"	12"	17¾"	"	1500	"	54.00
P4-5-30E	4"	1-1/2"	5"	10¾"	"	3000	37,500 LBS.	55.25
P4-6-30E	4"	1-1/2"	6"	11¾"	"	3000	"	57.25
P4-8-30E	4"	1-1/2"	8"	13¾"	"	3000	"	61.50
P4-10-30E	4"	1-1/2"	10	15¾	"	3000	"	65.75
P4-12-30E	4"	1-1/2"	12"	17¾"	"	3000	"	69.75
INSERTED CAP TYPE								
P3-4-15-1	3"	1-1/8"	4"	11½"	Inserted	1500	10,500 LBS.	34.25
P3-8-15-1	3"	1-1/8"	8"	17½"	"	1500	"	39.50
P5-12-30-1	5"	2"	12"	21½"	"	3000	59,250 LBS.	85.00
P5-18-30-1	5"	2"	18"	27½"	"	3000	"	97.50
P5-24-30-1	5"	2"	24"	33½"	"	3000	"	115.00
P5-30-30-1	5"	2"	30"	39½"	"	3000	"	135.00

EXTERNAL CAP TYPE

INSERTED CAP TYPE

4-WAY, OPEN CENTER HYDRAULIC CONTROL VALVE

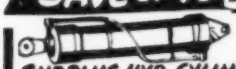
Has built-in adjustable relief valve, set at 1000 PSI with a spring loaded neutral position. Used for controlling (1) double action cylinder of the types shown in this advertisement. Can also be mounted in series. Has 3/4" standard pipe inlet & outlet ports. 1/2" pipe thread cylinder port. Shipping weight 10-1/2 pounds. . . . . **21.50 NEW**

NEW - HEAVY DUTY HYDRAULIC CYLINDER

A rugged, heavy duty cylinder. All steel construction. Double action. Has 7" bore, 13" stroke. 2½" steel shaft. Ideal for use in hydraulic presses, leveling ramps, hydraulic tail gates, industrial machinery, road machinery, etc. Shipping weight 180 pounds. . . **95.00**

GB-8-25 TON HYDRAULIC CYLINDER Same as above except has 8" bore, 15" stroke. Will give 50000 lbs. thrust at 1000 PSI. Shipping weight 185 lbs. **105.00**

SAVE UP TO 85% ON GOV'T SURPLUS HYDRAULICS



SURPLUS HYD. CYLINDERS

Gov't Surplus Bargain. Produces up to 40,000 lb. thrust with a 3000 PSI line pressure. May also be used as a low pressure air system cylinder. Has a 4" bore, 18" stroke, 30½" length. Part No. 29. New & Used.

NEW **43.95** USED **29.95**

Part No. 27A. Finest Surplus. For use up to 1500 PSI. Has bore of 3½", stroke 21-5/8", shaft 1". Length 29¾". Ports 3/8" AN pipe. **35.77**

Part No. 27B. Similar to above. Will stand up to 2000 PSI. Has internal stroke cushion in both directions. Bore 3-7/8", stroke 23", shaft 1-3/8", eye-to-eye length closed is 40-3/4". Ports are 1/2" AN pipe. **45.00**

Part No. 27C – Similar to 27A above. Take up to 1500 PSI. Has 3-1/2" bore, 23" stroke, 1-1/2" shaft, 34" closed lgth. 1/2" AN pipe ports. **45.00**

TELESCOPING HYDRAULIC CYLINDER

Thrust shaft is in two stages. First stage extends 39" – the second stage extends 18". Each stage works seperately. The overall length eye-to-eye is 61½". Inner shaft is 2-3/4" dia. outer shaft is 3¼" dia. Bore is 4¼". Ports are 1/2" AN pipe. **165.00**

10,000 PSI HAND PUMP AND RESERVOIR 19.75

For use with a short stroke press or as a static pressure booster pump. Reservoir mounts vertically with a capacity of 45 cu. inches. Has two position handle. . .

HYDRAULIC HAND PUMP – Has 1500 PSI operating pressure. 1.5 cu. inch capacity per complete cycle. Top condition. **12.75**

4-WAY BANK VALVE

A Bank Valve containing four 4-way poppet type valves. Complete unit has a common inlet and outlet with a built-in relief valve and metering valve. The 4-way valves are independently controlled – pressure balanced with a neutral position. Ports are 3/8" AC tube (9/16"-20 thread **22.50**

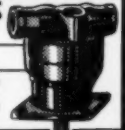
SURPLUS VICKERS PISTON TYPE-CONSTANT SPEED-HYD. PUMPS & MOTORS

Made to top Aircraft specifications. RPM shown below is the recommended maximum for constant speed. Quantities limited.

HYDRAULIC PUMPS					PRICES	
Part No.	Cu. in. per rev.	GPM	PSI	RPM	NEW	USED
PF9-713-20BCE	.410	5.3	1000	3000	—	$20.00
PF9-2713-20ZE	.410	5.3	1500	3000	$24.50	—
PF9-2713-10Z	.208	2.7	1500	3000	—	$22.50
PF2-713-25BCE	.507	6.5	1000	3000	$32.50	$22.50
PF50-3915-30YG	1.520	19.7	3000	3000	—	200.00
HYDRAULIC MOTORS						
MF9-713-15A	.310	4.46	1000	3750	—	$18.50
MF10-713-30B	.600	9.75	1000	3750	$57.50	—
MF9-713-25BCF	.507	8.25	1000	3750	—	$22.50

STRATO POWER HYDRAULIC PUMPS

Designed and built to finest aircraft specifications.



PART NO.	GPM	PSI	RPM	PRICE EA.
SP-3	12	1400	3750	NEW $27.50
P3C	20	1500	3750	NEW $125.00

180° OFFSET DRIVE

For use where tremendous power at a low take-off RPM is desired. Has 6 gears rotating on self-lubricating, hi-speed roller bearings. 85 to 1 gear ratio. Shafts are 1/4" and 3/8" in diameter. USED . **5.95** NEW – in excellent condition. **8.95**

HYD. HOSE & TUBING

We stock a complete line of Hydraulic Tubing and Hose as well as all types of fittings and hardware, Send us your requirements.

VICKERS AA20328 HIGH PRES. PUMP

Automatic, variable volume of 1850 to 2000 PSI continuous operating pressure. Has a continuous speed of 3750 RPM maximum. Displacement is .600 cu. in per rev. Will deliver up to 9.2 gallons per min. at 3750 RPM. Rotates right hand only. Will operate in any position, but top case drain must be connected to reservoir. Reservoir must be pressurized. Ports are 1" AN inlet and 5/8" AN outlet. . . . . ONLY **129.00**

SURPLUS VICKERS HYDRAULIC TRANSMISSION

Self-contained, constant torque at all speeds with variable volume, reversible piston pump which supplies hydraulic motor. Has 2 H.P. automatic pressure dash pot for smooth control. Power output RPM is 0 to 1/3 input RPM in both directions. Input RPM 1800 continuous, 4000 intermittent. Ideal for Lathes, Duplicator set-ups, Conveyors, Drives, etc. . . . **49.50**

4" **SPLINE SHAFTS** for input and power take-off on above. **$2.50 pair**

INPUT & TAKE-OFF PLATE ASSEM. To adapt trans. to pulley drive. Has high speed bearings and 1/2" keyway shaft. Per Set **20.00**

PESCO HYD. PUMP

A gear type pump. Will deliver 2 GPM at 1500 RPM with 1500 PSI – delivers 6 GPM at 4300 RPM with 1500 PSI. Has .375 cu. in. displacement per rev. Ports are 3/4" standard pipe. 5/8" male spline drive shaft. 4" pad mount. In good condition. **14.95**

NEW HYDRAULIC CATALOG

Showing our Complete line of New and Surplus Hydraulic Supplies and Equip. Includes Cylinders in 106 sizes and types. All types Valves, Fittings, Pumps, Hyd. Motors, etc. Write TODAY!

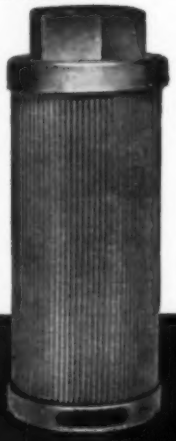
Order from this Ad. Pay by Money Order or Check. P.O.s accepted from well rated D&B firms. 1/2 Dep. with C.O.D.s. Prices F.O.B.

Palley SUPPLY CO.

2263 E. VERNON AVE., DEPT. AH-3 LOS ANGELES 58, CALIFORNIA

Circle 25 on Reader Service Card

★ONLY THREE PARTS
★MEETS J.I.C. STANDARDS
★GREATER FILTERING AREA
★SPECIAL TRAP-WEAVE MESH



The New

CAPITAL HYDRAULIC OIL FILTER

WITH MONEL METAL INSERT

Reservoir Type for Hydraulic and Oil Re-Circulating Machinery

EASY TO INSTALL • EASY TO CLEAN • LONG LIFE • LOW COST

SIZES AND SCREENS TO FIT YOUR NEEDS

CAPITAL ENGINEERING & MFG. CORP.
5837 South Ashland Avenue Chicago 36, Illinois

New Products / continued

ELECTRO MAGNETIC PICKUP
. . . has high sensitivity

Designation: Model 3030

Features: Transducer is small, rugged impulse generating device which converts mechanical motion

into sufficient electrical energy to operate electronic devices. The magnetic pickup generates a voltage output proportional to the rate of motion of any moving magnetic metal object. It can be actuated by the teeth of a gear, screw, pin or any projection on a moving object.

Applications: Electro magnetic pickups are used for indicating rpm, operations, cycles, angular and linear motions. They can actuate electronic counters and control electrical devices when used with amplifiers and relays.

Electro Products Laboratories
Chicago, Illinois

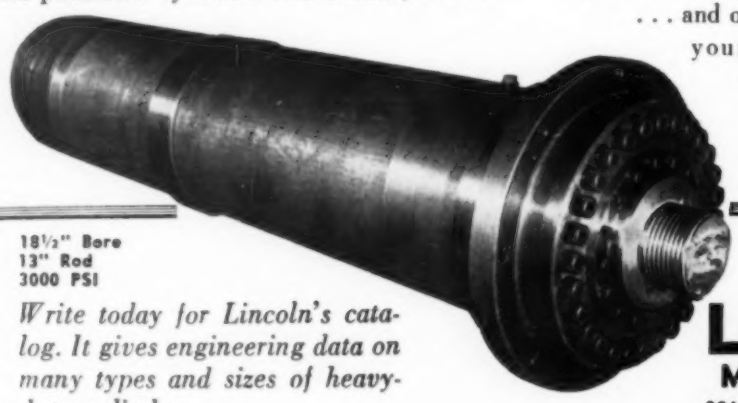
Circle 192 on Reader Service Card

Air and Hydraulic Cylinders

• FOR HEAVY-DUTY APPLICATIONS OF ALL TYPES • TO MEET ALL SIZE AND PRESSURE REQUIREMENTS • BORES TO 60″ DIAMETER • STROKES OF 50 FT. AND LONGER

Lincoln Machine Company will design, engineer and build standard or special hydraulic and pneumatic cylinders with trunion, rod-end flange, blank-end flange, foot, clevis or centerline mountings.

Call on Lincoln when you require large, powerful rotating or non-rotating hydraulic and air cylinders, heavy-duty mill-type cylinders. Our engineering department will give you fast, practical assistance in design problems . . . and our modern plant will build your cylinders quickly and economically.



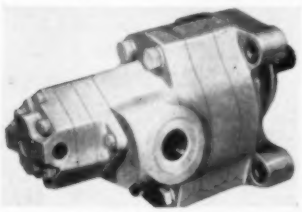
18½" Bore
13" Rod
3000 PSI

Write today for Lincoln's catalog. It gives engineering data on many types and sizes of heavy-duty cylinders.

LINCOLN
MACHINE CO., INC.
326 West 2nd Street—Salem, Ohio

TANDEM PUMP
. . . for power steering

Design: Two pumps have mating shafts and operate from a common driving unit eliminating the cost of a second drive unit. A common inlet cuts the amount of hydraulic piping, and further reduces costs. Compact design simplifies installation, reducing time previously required and eliminating many installation problems. Flexibility of



unit permits initial use of the larger pump alone with a cover plate, and later addition of the smaller pump without the need of additional inlet piping.

Specifications: Capacities of the tandem pump combinations range from 4.8 to 29.0 gpm at 1000 psi for the larger pump, and 1.0 to 4.0 gpm at 1000 psi for the smaller pump at 1750 rpm. Smaller pump is normally used in power steering installations.

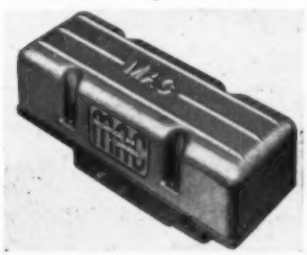
Webster Electric Co.
Racine, Wisconsin

Circle 193 on Reader Service Card

3-POSITION AIR VALVE
. . . open or closed center

Designation: Model 1013, 1023

Design: 3-position, 4-way, double-solenoid, spring-centered air valve is available with open center (Mod-

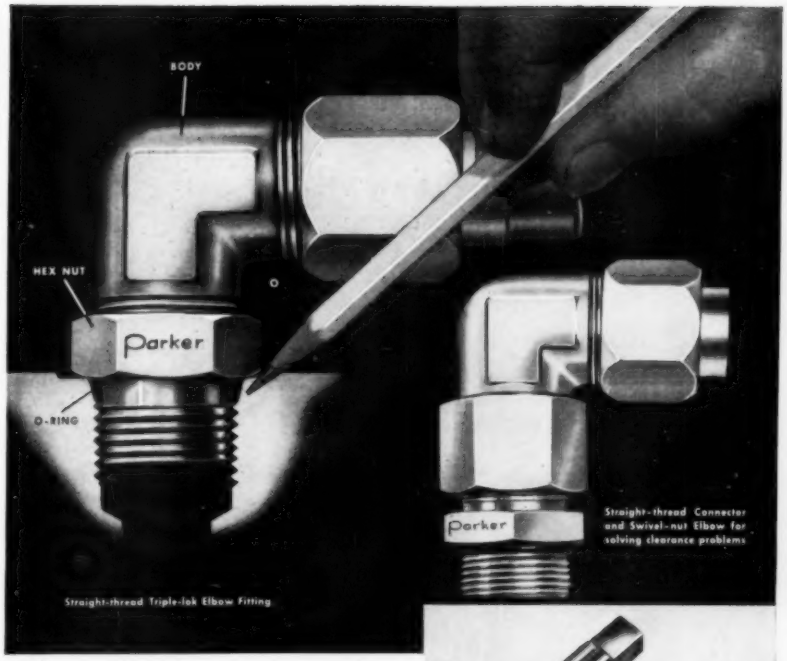


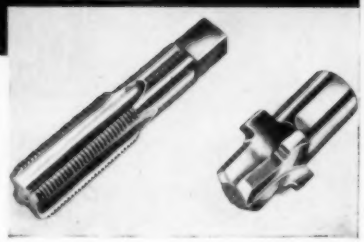
el 1013) or closed center (Model 1023). With open center, cylinder ports are open to atmosphere and pressure is blocked. With closed center model cylinder ports are blocked locking the rod. Both models are available in ⅜-inch IPS. Side porting is standard, but bottom ports are available.

Mechanical Air Controls, Inc.
Detroit, Michigan

Circle 194 on Reader Service Card

Continued on next page





Precision thread-tapping and counterboring tools for making accurate *straight*-thread boss (to receive these new Parker *straight*-thread fittings) are now available with machining drawings from Parker.

New Parker *straight*-thread fittings solve your leakage problems

Now you can forget about high-pressure hydraulic problems resulting from tapered pipe threads. Forget about leakage . . . about the danger of cracking or distorting valve bodies by over-tightening the fittings . . . about damaged threads from over-tightening to obtain proper positioning. Forget about messy pipe "dope".

You can eliminate all of these problems by using new Parker *straight*-thread fittings with positive O-ring seals. (See illustration above.)

Parker *straight*-thread fittings are now being supplied in response to the growing demand for this new type of leakproof, trouble-free connection. They are shorter and have smaller hexes than the AN fitting for the old AND 10050 boss. *Straight* threads are available on *Triple-lok* (the industrial standard flare tube fitting) and on *Ferulok* (flareless fitting for heavy steel tubing).

This is another example of Parker's pioneering leadership in the field of hydraulic fittings. Write for Cat. 4301.

TUBE AND HOSE FITTING DIVISION
Section 414-F
The Parker Appliance Company
17325 Euclid Ave., Cleveland 12, Ohio

Parker
Hydraulic and fluid system components

Circle 110 on Reader Service Card

New Products / continued

CHECK VALVE
. . . for 300 psi hydraulic service

Designation: Model 1008 and Model 1058

Features: These ½ inch aluminum alloy check valves provide a weight saving of more than 55 percent over conventional types. They are AN-approved. Having an ambien temperature range of −65 degrees F to +160 degrees F, these valves insure uni-directional flow and will withstand in excess of 50,000 cycles. For higher temperature ranges the valves can be supplied with seals for 275 degrees F service.

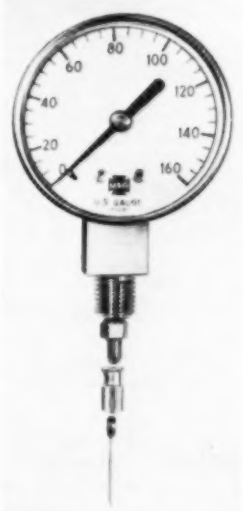
Specifications: Model 1008 (illustrated) has external threaded ends, Model 1058, internal threaded ends. Valves for lower pressures are also available.

Aircraft Products Co.
Bridgeport, Pa.

Circle 195 on Reader Service Card

PRESSURE GAGE
. . . taps air hose

Features: Two-inch diameter gage is equipped with hypodermic needle and guard to permit tapping air



hose at the tool. This determines pressure available at the tool regardless of original pressure or number of tools on the line. Unit is finished in chrome.

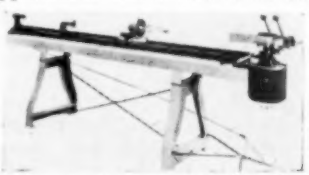
U. S. Gauge Div.
American Machine & Metals, Inc.
Sellersville, Pa.

Circle 196 on Reader Service Card

TUBE BENDER
. . . for extended runs

Designation: Bendmaster

Features: Bender is designed for applications where more than one



bend per tube is required. Self-indexing system pre-sets machine for entire sequence of bends. Tubing

Continued on page 152

LET GOSHEN RUBBER help you with "APPLICATION-ENGINEERED" PRODUCTS . . .

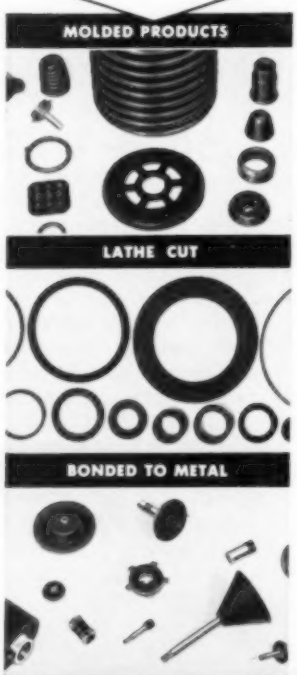
of NATURAL, SYNTHETIC and SILICONE RUBBERS

make GOSHEN your HEADQUARTERS for

Products by Goshen Rubber are precision-fabricated and "application-engineered" to meet strictest specifications as to compound, service life and operating satisfaction. Small parts are a specialty . . . compression molded, transfer molded, or precision cut . . . to critical tolerances.

Goshen is also a dependable source for precisely molded O-rings, specially compounded to MIL, AMS and industrial specifications, in MS, AN, SAE, and JIC standard sizes and special shapes.

Inquiries regarding any rubber parts problem are invited, particularly in the design stage.



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This 8-page brochure and handy file folder tells how Goshen Rubber can help you. Send for your free copy today.

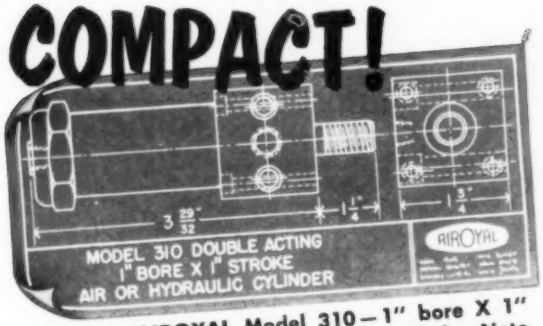
See our "Facilities" catalog in Sweet's Product Design File.

Goshen Rubber Co. INC.
CUSTOM DEVELOPMENT AND FABRICATION SINCE 1916
Our 40th year 1916 · 1956

1336 S. TENTH ST. • GOSHEN, IND.

Circle 5 on Reader Service Card

COMPACT!



This is an AIROYAL Model 310—1" bore X 1" stroke double acting air or hydraulic cylinder. Note its small size. It's been designed into the smallest package possible without sacrificing its strength for severe duty applications. You'll find AIROYAL small bore (1", 1½" and 2") cylinders just right for those jobs where space is restricted.

Other features you will appreciate are:

- UNIVERSAL MOUNTING—the cylinder can be mounted from either the two transverse holes or the four longitudinal holes;
- EXTERNALLY HONED STAINLESS STEEL PISTON ROD—resulting in extra long rod packing life;
- LOW PRICE—the cylinder shown above, for either 150 p.s.i. air or 1500 p.s.i. oil, is only $27.00 list.

MANUFACTURED BY

THE AIROYAL CO.

1990 SPRINGFIELD AVENUE
MAPLEWOOD, N. J.
REPRESENTATIVES IN PRINCIPAL CITIES

YOU CAN TRY USING OLD NYLONS INSTEAD OF PISTON RINGS IN HYDRAULIC AND AIR APPLICATIONS

. . But . .

THERE IS NO SUBSTITUTE FOR THE MORE ECONOMICAL, MORE DEPENDABLE, LONGER SERVICE LIFE OF

Engineering and design service available. Write for price information and catalog data.

Manufacturers of:
Industrial piston rings for high compression service.

grover
PISTON RING CO.

120 NORTH BROADWAY • MILWAUKEE 2, WISCONSIN

Circle 162 on Reader Service Card

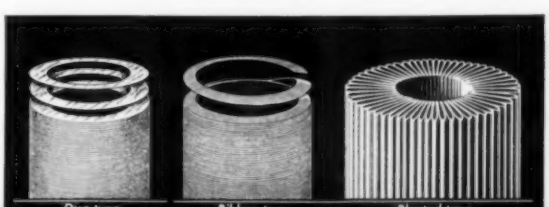
NOW—AN ENTIRELY NEW *Bendix-Skinner* HYDRAULIC OIL FILTER

Approx. ½ size

OFFERING YOU FINER FILTRATION AT LOWER COST!

Here's everything you've wanted in a filter, including a built-in bypass—and all at a price equivalent to only six quarts of hydraulic oil! Yes, this newest addition to the Bendix-Skinner* line is truly the last word in efficient, yet economical, filtration. Its sturdy aluminum die cast construction assures long service—trouble-free, because it is available with either cleanable "ribbon" type elements for 40-micron filtration, replaceable "pleated" type for 10-micron filtration, or "disc" type, cleanable in 5 or ½ microns. Two ¼-inch N.P.T. inlets and two ¼-inch N.P.T. outlets make installation quick and easy. Operating pressure—100 p.s.i. Complete flow rate-pressure drop data on request.

*TRADE-MARK



BENDIX-SKINNER DIVISION OF
P.O. BOX 135, ROYAL OAK, MICHIGAN

Bendix
AVIATION CORPORATION

Export Sales: Bendix International Division, 205 East 42nd Street, New York 17, N. Y.

ORIGINATOR OF **MICRONIC** FILTRATION

Circle 19 on Reader Service Card

for production brazing...

LUCAS MILHAUPT
SILVER BRAZING
PREFORMS

RINGS
Round Wire, Machine Wound, Mandrel Wound.

RINGS
Flat Wire, Machine Wound, Mandrel Wound.

ODD SHAPES
Any size or form.

WASHERS
Edgewound and Blanked.

Preforms in any size or shape that...

1. End Wasted Time In Placing Silver Solder in position for brazing.
2. Speed Assembly Work.
3. Eliminate Rejects.
4. Meter Silver Solder to Flow In and Around Joints.

To do your silver brazing job better, Lucas-Milhaupt offers a wide range of silver brazing preform sizes and shapes. In addition to round and flat wire rings, blanked and edgewound washers, Lucas-Milhaupt provides a complete line of preforms which include such shapes as elliptical, rings, hinged rings, segments, slugs, U clips, hairpins, etc. Send your drawings or sample part and the proper preform will be designed to do your brazing job faster at less cost.

FREE... 16 page booklet gives you all the facts on better brazing with preforms. Write Today!

5052 SOUTH LAKE DRIVE • CUDAHY, WISCONSIN

New Products continued

remains in machine throughout bending process. Automatic stops control tube rotation, angle degree, and spacing of bends to provide absolute uniformity of finished pieces. Bender accommodates all annealed ferrous and non-ferrous tubing from ¼ to 1-inch OD.

Leonard Precision Products Co.
Santa Ana, California
Circle 197 on Reader Service Card

PNEUMATIC DISCONNECT . . . with positive ball lock

Features: Pressure drop through the disconnect is equivalent to that

through a straight tubing section. When disconnected the checked end serves as a bubble-tight, leak-proof shut off valve. The positive ball lock guarantees safety of the connection under severe vibration and also provides a sight-and-feel indicator assuring a completely coupled and saftied condition.

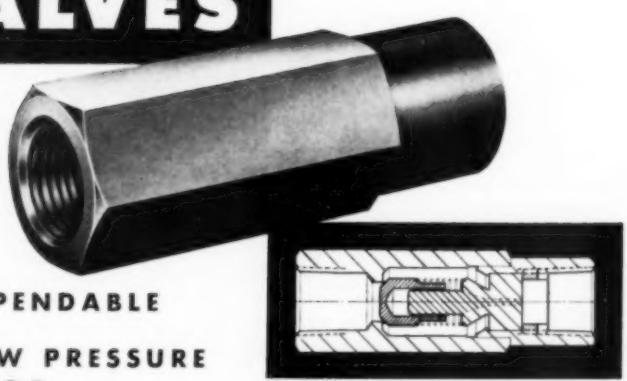
Application: Only ¼ turn by hand is required to connect or disconnect. When disconnecting, the unique safety interlock automatically bleeds down trapped air, eliminating all danger to personnel. The unit can be disconnected or connected under pressure as high as 3000 psi. Disconnect is made in ¼ and ⅜-inch sizes.

Eastern Aircraft Products Corp.
Orange, New Jersey
Circle 198 on Reader Service Card

FLOW TRANSDUCER . . . is bi-directional

Features: Transducer is installed in the line in any position and senses rate of fluid flow as a product of the dynamic forces acting up-

CHECK VALVES



- DEPENDABLE
- LOW PRESSURE DROP
- LOW COST
- FOR OIL

- For Oil
- Copper Brazed Steel Bodies
- To 3000 P.S.I. Service
- Pipe Sizes ¼", ⅜", ½", ¾"

Write or phone Mentor, Ohio, Blackburn 5-2625 for complete specifications.

Fluid Controls, inc.

Manufacturers of Hydraulic Valves and Devices
Relief Valves • Check Valves • Restrictor Valves
Needle Valves • Pilot Check Valves • Special Valves
Pressure Compensated Flow Regulators

1284 N. CENTER STREET • MENTOR, OHIO

on a geometric body of revolution in the flow stream. This force is translated by a strain gage into an electrical output. Bi-directional feature makes the instrument particularly applicable to hydraulic pump and actuator testing.

Specifications: Unit has range from .2 to 125 gpm. Phase sensitive instrument detects direction of

flow and indicates accordingly. Transducer requires input of 5 to 10 volts ac or dc, and is rated for 500 psi working and 1000 psi maximum pressure.

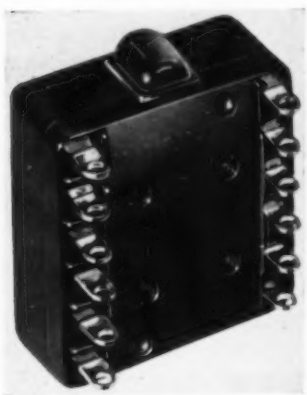
Ramapo Engineering Co.
Riverdale, New Jersey

Circle 199 on Reader Service Card

ELECTRIC SWITCH
. . . controls six circuits

Designation: Model K 3-4

Features: Snap action switch gives control of six circuits simultaneously from a single actuation. Unit can



be used to reverse current flow through two windings of a 3-phase motor up to 1 hp and other types of multi-switching operations. Action of three poles is totally independent of the speed of actuation making it suitable for installations where even extremely slow moving cams are used. Electrical rating of the switch is 15 amp, 125/250 volts ac or 30 volts dc.

Electro-Snap Switch & Mfg. Co.
Chicago, Illinois

Circle 200 on Reader Service Card

SPECIAL CYLINDER
. . . 16-inch bore

Construction: Cylinder has 36-inch stroke and operates at pressures to 2000 psi. Cast steel front head with reverse, round flange mounting is welded to the forged steel cylinder. Rear head is bolted to the cylinder. Bearing bronze bushings in front head and on pis-

ton guide ram and piston assembly. Cylinder has 1¼-inch pipe tap flanges, and net weight is 5100 lb.

The Oilgear Co.
Milwuakee, Wis.

Circle 201 on Reader Service Card

Circle 149 on Reader Service Card

Circle 36 on Reader Service Card

RUGGED, HEAVY-DUTY
HYDRAULIC CYLINDERS

Attention: O. E. M.
Prompt delivery on
any quantity . . .
high quality . . .
low cost!

Built-in Mechanical Stroke Control

Free catalog and
engineering
survey,
no obligation.

WRITE...PHONE...WIRE
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LEWIS ■ PHONE 81 ■ KANSAS

"Indispensable to those working in the field of hydraulic power."
—MIDWEST ENGINEER

Hydraulic Operation
and
Control of Machines

Ian McNeil

ON-THE-JOB operating handbook and reference guide for practicing engineers working with hydraulic equipment of all kinds. Organizes in easily accessible form essential information needed in solving operation and maintenance problems of hydraulically driven machinery.

Both established methods and important new developments are thoroughly described, and future trends are indicated. Covers: hydrostatics; pumps and motors; valves and circuits; power-saving devices; use of hydraulic equipment in machine tools, mining, aeronautics, marine engines, agriculture, lifting devices.

Offers a wealth of information on hydraulic packing, fluid media, and the maintenance of hydraulic plants.

31 plates, 103 figures, 324 pp. $7.50

Send for this book. Save postage by remitting with order. Write Dept. AH-3.

THE RONALD PRESS COMPANY
15 East 26th St., New York 10

Useful Literature continued

HOSE AND FITTINGS . . . manufactured by Anchor Coupling Co., Inc. are covered by three catalogs recently prepared by the company. Catalog No. 100 presents a wide range of factory assembled high, medium, and low pressure hose assemblies. Also included are flow charts, nomographic chart, thread information, and methods for computing length of hose assemblies. Catalog No. 200 features a broad line of adaptor unions, pipe fittings, and boss and bulkhead adapter unions with dimensional drawings and engineering aids. Catalog No. 300 details a wide range of reusable and clamp type couplings and hose assemblies for high, medium, and low pressures.

Circle 227 on Reader Service Card

AIR PRESSURE REGULATORS . . . filters, and lubricators are shown in Folder F-15AH from Watts Regulator Co. Combination units are shown in addition to an air relief valve and two types of strainers. The regulators respond instantly to sudden large volume demands without excessive pressure drop. Available with body connections up to 4-inch female NPT, the regulators can be obtained with standard T handle or control knob. The regulators are rated for inlet pressures to 250 psi and reduced pressure ranges of 2-30, 25-50, and 45-100 psi.

Circle 228 on Reader Service Card

PNEUMATIC, HYDRAULIC CYLINDERS . . . Conformance with JIC and Ford Motor Co. Industrial Equipment Standards NCIX and NC-1 are stressed in Bulletin M-M issued by Neptune-Power Plus Products Co. to specify their cylinders. The cylinders are made in four series for 200-psi air, 750-psi oil, 1500-psi oil, and 3000-psi oil service. In addition to complete dimensional data, the bulletin includes tables of air pressure, force, and volume; capacities of hydraulic cylinders; and exerpts from JIC Standards applying to cylinders.

Circle 229 on Reader Service Card

SOLENOID VALVES . . . for oil and water at pressures of 250, 1500, and 3000 psi are described in two brochures recently published by Barksdale Valves. The valves employ the "shear seal" principle and are made in 3-way and 4-way designs. The design for water service is not critical to pipe scale or other foreign material because lapped sealing members are in constant intimate contact and a square corner wipes away dirt. Port sizes are ¼, ⅜, and ½ for the 250 and 1500-psi valves, and ¼, and ⅜ for the 3000-psi valves. Valve characteristics including current drain, minimum flow passage, rated flow, and weight are given.

Circle 230 on Reader Service Card

"QUICK SEAL COUPLINGS" . . . is a new catalog on quick connect-disconnect hose couplings, products of Titeflex, Inc. Large cutaway views of the straight-through coupling and the check-valve coupling show clearly the construction and design of these units. These have a unique sealing action which makes the coupling tighter as internal pressure increases, and have a full swiveling action that prevents hose twisting. To facilitate ordering, tables and diagrams are included to indicate available coupling sizes and types of hose connection. Instructions are given for selecting the right type and size for a particular application. Numerous applications of the connectors are illustrated.

Circle 231 on Reader Service Card

BACK-UP RINGS . . . corresponding to the military specification on single-turn Teflon back-up rings are listed in Catalog Sheet S-11248 released by Shamban Engineering Co. Dimensions of available rings are listed.

Circle 232 on Reader Service Card

HEAT EXCHANGERS . . . Instead of presenting performance data in the usual tabulated form, Catalog 552 recently published by E. C. Cooley Co. shows this information by a carefully prepared system of easily understood curves and examples. Whereas tabulated data may fail to give an accurate picture

Continued on page 156

Circle 75 on Reader Service Card

MICRO DELTA-P controller

this Back Pressure Controller Emphasizes

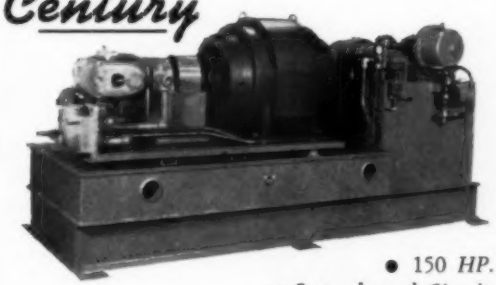
- SPEED
- ACCURACY
- SIMPLICITY
- COMPACTNESS

Bulletin 542 gives you all the details. Write:

INDUSTRIAL ENGINEERING CORP. 527 E. Woodbine, Louisville 8, Ky

Makers of GG gage gard and Functional Test Equipment

SPECIAL POWER PACKAGES *by.....* Century



- 150 *HP.*
- *Supercharged Circuit.*
- *Operates at* 5000 *PSI.*

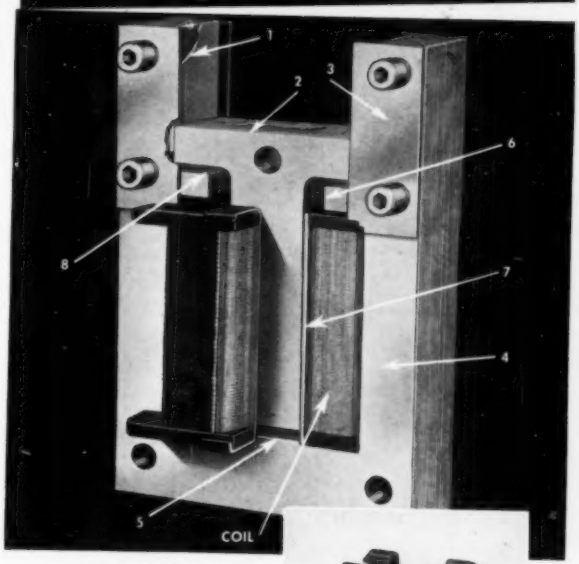
Variable displacement pump. Constant temperature control on hydraulic oil. Power package drives a hydraulic motor at speeds up to 2000 *RPM.*

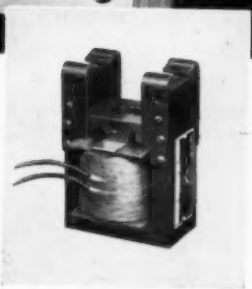
In addition to designing and building of special power packages, Century carries in stock a complete line of standard tanks ready for immediate assembly.

For power unit requirements it's

CENTURY HYDRAULICS, INC.
7701 LYNDON AVE. • DETROIT 38, MICHIGAN
Telephone DIAMOND 1-3797

NEW! Non sticking, greaseless, long life SHORT STROKE SOLENOIDS for original Equipment or *replacement use





PULL CAPACITY
1 lb. to 300 lbs. at 85% voltage; 1.4 lbs. to 420 lbs. at 100% voltage. Strokes ½" to 1½"

***INTERCHANGEABILITY**
Complete interchangeability with National Acme line of solenoids, size for size, and all combinations and modifications.

ONLY Trombetta Solenoids Offer All These Features

NON-MAGNETIC METAL GUIDES (1 and 3)

By the use of heavy non-magnetic metal guides (1 & 3) for plunger head (2) the following advantages are obtained:

(a) All possibility of magnetic sticking and dragging is eliminated;

(b) No heavy grease lubrication for plunger is required;

(c) Solenoid may be mounted in any position and at any angle to the vertical, without in any way affecting its operation or the length of its useful life;

(d) It is not necessary to make the plunger (2) precision fit to the frame; (4)

(e) When mounting the solenoid it is not necessary to align it precisely to eliminate side thrusts in plunger head;

(f) With 1/16" thick non-magnetic metal guides (1) between plunger head and frame, the guides must wear 1/16" before magnetic sticking and dragging sets in, whereas, without non-magnetic metal guides, only a few thousandths of an inch combined wear of plunger head and frame are required to start magnetic sticking and dragging and to render the solenoid unreliable and inoperative;

(g) Thus the life expectancy of the solenoids is increased manyfold and the solenoid remains completely reliable throughout its life;

(h) It is fairly well established that the guides of the type and thickness we use outlast the rest of the solenoid.

THREE CONTACT SURFACES, (5, 6 and 8)

By the use of three contact surfaces, all of them pole shaded, the solenoid can be made as quiet as desired without any difficulty.

THREE IMPACT SURFACES, (5, 6 and 8)

The use of three impact surfaces triples the life of the solenoid as compared with similar solenoid using only one impact surface, even if that one impact surface be provided with a spot of hard metal.

COIL

By impregnating the coil with the best waterproof, oil-proof, and acid-proof varnishes and baking it very carefully and adequately, all troubles from oils, cutting compounds, water and acids are automatically and completely eliminated.

With the introduction of this line, the Trombetta Solenoid Corporation is in a position to furnish any and all requirements in solenoids ranging from short stroke to long stroke and high speed solenoids for duty cycles up to 600 *operations per minute.*

Write for Bulletin EE 178-A

TROMBETTA SOLENOID CORP.

328 N. MILWAUKEE ST. MILWAUKEE, WISCONSIN

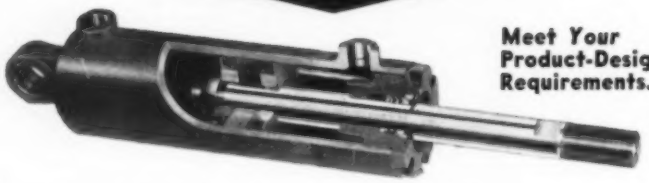
U.S.A

Circle 20 on Reader Service Card

HYDRAULIC CYLINDERS

CUSTOM-DESIGNED

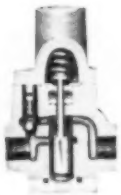
by B.H.E.W.



Meet Your Product-Design Requirements.

Dependable performance in minimum mounting space is characteristic of B H E W hydraulic cylinders. Standard and special O.E.M. designs of all types, sizes and any mounting style are available on order . . . delivered on schedule.

Send specifications of your requirements for ANY kind of hydraulic, pneumatic and water cylinder.



BHEW

Lift trucks need the B H E W Pressure-Operated Hydraulic Flow Control Valve. It eliminates surge as load starts down. Load-weight controls rate of descent.

Benton Harbor Engineering Works, Inc.

St. Joseph, Michigan

Useful Literature continued

of heat exchanger performance under varying field conditions, curves which cover the full performance range can cope with future, or seasonal needs of the system in which the installation is made. Over a year has been devoted to the development of the performance curves presented in the 32-page catalog. Also covered in the catalog are reliable comparisons of the various types of shell and tube heat exchanger equipment.

Circle 233 on Reader Service Card

AIR COMPONENTS . . . Bulletins, price sheets and specifications of A. K. Allen Co. have been spiral-bound into a catalog which is now available. The material describes a complete range of valve-in-head, single and double ended cylinders; solenoid, pilot, and hand air valves; spring return clamps and three models of dial-feed index tables. The mechanically actuated valves are available in a number of designs and can be supplied with a pneumatic timer.

Circle 234 on Reader Service Card

GRESEN HYDRAULICS

VANE PUMPS

With Dual Vane Feed

For Mobile, Industrial, Agricultural Uses

SPECIFICATIONS
3-6-9-12-16-20-24 G.P.M.
Max. 2000 R.P.M.

ROTATION
Clockwise-Counter Clockwise
Mounting Feet Available

Write for literature

GRESEN MANUFACTURING CO.

628 Colfax Ave. N. Dept. H-16 Minneapolis 11, Minn.

Clamp Hydraulically and Slash Fabrication Costs!

Simple Units
Inexpensive
Equal Pressure at all Points
No Distortion
Instant Clamp Release

NEWTON PRODUCT MARK
CLAMP
Hydraulic MULTIPOINT

For MILLING
GRINDING
WELDING
GLUEING
and every other clamping problem

A NEWTON PRODUCT

Please send for Publication No. P/243

POWER JACKS LIMITED

VALETTA RD · ACTON · LONDON · W.3

Telephone: Shepherds Bush 3443/6 Telegrams: Newsorber, Ealux, London

Circle 60 on Reader Service Card

Circle 115 on Reader Service Card

ROTARY AIR MOTORS . . . which are explosion-proof are offered in two sizes of 2 and 4 hp. in a brochure from Gast Manufacturing Corp. Specific advantages of the air motors are listed and include variable speed, ability to stall without harm, instant starting in any position, compactness, and light weight. An example for calculating torque is given and performance data is presented in the form of two graphs showing horsepower related to rpm and power related to air consumption. Dimensional data is included for the two models.

Circle 235 on Reader Service Card

TEMPERATURE AND PRESSURE CONTROLS . . . for industrial, aircraft, marine, and special applications are outlined in a bulletin from United Electric Controls Co. The controls including immersion thermostats, bulb thermostats, and various types of pressure switches are each illustrated with a short statement of the outstanding features. The company's Type H5 pressure switch is a general purpose unit for air, gas, or liquid pressures to 500 psi. It has an outside adjustment knob and calibrated scale for limited or wide ranges.

Circle 236 on Reader Service Card

AIR COMPONENTS . . . including cylinders, valves, and air motor consisting of cylinder and integral air or solenoid valve are described in recent literature from Air Control Div. of Lehigh Foundries, Inc. Complete dimensional data is given for the cylinders which range from 1½ to 12-inch bores. The literature also shows a smaller line of cylinders with bores of 1¼, 1¾, and 2½ inches. The piston valves shown consist of only two components: body and piston. They can be supplied as units or fitted with various types of operating mechanisms including hand, foot, mechanical, and various types of air operation. The double-acting air motors have sealed-in lubrication and are either electrically or pneumatically controlled.

Circle 237 on Reader Service Card

COUPLING . . . Oil carries the load in the coupling described in Koppers Co., Inc. Fast's Coupling Dept. leaflet. By locating the load-carrying surfaces at the maximum distance from the shaft ends, misalignment between the splines is reduced to 1/10 the misalignment between shafts. Even under maximum load the shafts float with little resistance. Centrifugal force distributes the oil so that the splines are continuously immersed in oil. The oil film cushions the power transmitted and eliminates all metal-to-metal contact. Dimensional data and ordering information is given in the leaflet.

Circle 238 on Reader Service Card

NEW PACKING STANDARDS . . . a new edition of Hydraulic and Pneumatic Packing Standards for Leather and Synthetic Rubber has been issued by the E. F. Houghton & Co. In this edition, "V" packings have been divided standard and heavy, the same stack height for fabricated and homogenous and for leather packings have been established and standard sizes for adaptors for "V" packings are listed for the first time. All packings and adaptors are identified by dash numbers and some reduction has been made in the number of sizes in the interest of simplification.

Circle 239 on Reader Service Card

Continued on next page

New booklet describes advantages of Superior hydraulic quality tubing

Tubing is the modern, efficient method of handling fluids. Because it saves space and weight and is easily bent and flared, the number of fittings required is reduced and so are installation costs. In addition, it offers tighter joints, greater strength, and less pressure drop.

Seamless hydraulic tubing has been a SUPERIOR speciality for many years. From the melting of the steel to the final flare testing of the finished tube, the production of SUPERIOR low-carbon tubing is a quality operation. Tubing is given a 100% hydrostatic test at pressures which raise the fiber stress to 15,000 psi—in many sizes well above the 1000 psi minimum required by SAE-JIC specifications. Carbon content is held to .12% maximum for greater ease of bending and flaring, and each order is tested for flareability. The steel used is of a non-aging type made under a special melting process to insure low yield strength and unusually high elongation. Sizes range from ⅛″ to 1⅛″ OD.

Complete information concerning SUPERIOR HYDRAULIC tubing, including maximum working pressures, bursting pressures, velocity and flow charts, etc., is contained in a new booklet, shortly to be published. Use the coupon to obtain your free copy, testing samples—and the name of the SUPERIOR distributor nearest you. On the West Coast, write Pacific Tube Co., 5710 Smithway St., Los Angeles 22, Calif.

SUPERIOR TUBE COMPANY
2030 Germantown Ave., Norristown, Pa.

☐ Please send me a free copy of Bulletin 39 on Superior Hydraulic Tubing as soon as it is released.

☐ Send me a free sample of hydraulic tubing ″ OD and ″ wall to be used for_____.

☐ I would like to know the name of the distributor nearest me.

Name.....
Title.....
Company.....
Street.....
City..... Zone.... State.....

Circle 144 on Reader Service Card

Useful Literature continued

REINFORCED TEFLON . . . named Duroid 5600 developed by Rogers Corp. is described in Bulletin No. 1 and accompanying Data Sheet available from the company. The value of Duroid 5600 lies primarily in its superior resistance to heat distortion, cold flow, or extrusion as compared to Teflon. This improvement has been obtained at some sacrifice of Teflon's excellent electrical and dry lubricating properties. In aircraft applications Duroid 5600 back-up rings of the flat, scarf-cut type have run over 50,000 cycles at 500 F in diester hydraulic fluid without appreciable deterioration. The Data Sheet gives complete properties of the material compared to Teflon.

Circle 240 on Reader Service Card

GEAR LUBRICANT . . . for application on highly loaded gears which normally can only be lubricated infrequently is specified and described in Bulletin 105 distributed by The Alpha Molykote Corp. The lubricant is a near-colloidal dispersion in a viscous, tacky and adhesive petroleum oil which has been rendered fluid by the addition of a volatile non-flammable diluent. The lubricant is particularly useful where only one or two gears of a long gear train are exposed and lubrication of the train must be achieved through transfer of the lubricant from gear to gear. Properties of the fluid are shown by graphs of tests and prices are included.

Circle 241 on Reader Service Card

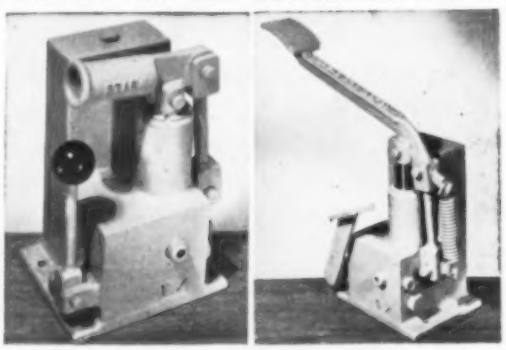
AIR PUMPS . . . with three different types of cooling are discussed in three bulletins recently released by The Kraissl Co. The air-cooled pump for operation where a temperature of 200 degrees F will not be exceeded is specified in Bulletin No. A-1679 which outlines the application, design, construction, specifications, and operating instructions for the unit. Water jacketed air pumps designed for continuous duty with higher pressure and vacuum characteristics than can be accommodated by radiant cooled pumps are covered by Bulletin No. A-1523. Fan cooled pumps for use where water cooling is unavailable or inconvenient are outlined in Bulletin No. A-1770.

Circle 242 on Reader Service Card

SOLENOID VALVES . . . which are panel mounted are the subject of Catalog 261 now available from Rivett Lathe & Grinder, Inc. The catalog is a complete file on panel-mounted solenoid valves, emphasizing features of construction and operation with cutaway views, piston designs, and JIC symbols. The valves are fully shock resistant and may be mounted horizontally or vertically. They are rated for 3000 psi and meet all JIC requirements. A feature of the valve is that by changing pipe tap size in the sub-plate, the 1-inch basic valve may be used for either ⅜, ½, ¾, or 1-inch IPS. The 1½-inch valve may be used

Continued on page 160

STAR Hi-Lo TWO SPEED CONCENTRIC PUMPS



HAND OR FOOT OPERATED WITH SINGLE LEVER OR PEDAL

Two speed construction provides automatic change-over during operating cycle from high speed low pressure to low speed high pressure.

MAXIMUM CAPACITY 10,000 P.S.I.

Safety overload valves—Hard chrome plated pistons—Piston stroke 1½ inch—Oil capacity 150 cu in or larger—5 models: (½"-⅞"), (½"-1¼"), (½"-1½"), (⅝"-1½"), (½"-2¼").

Special engineering counsel and proposals cheerfully submitted on request. Ask for Catalog #555.

Representative areas available

STAR JACK CO., INC.
420 LEXINGTON AVENUE, NEW YORK 17
PLANT: RIVER GROVE, ILLINOIS

Circle 141 on Reader Service Card

O-RINGS are a valve's best friend

Drippy, leaky valves are just not socially acceptable . . . so, we designed the new Hoke bar stock needle valve with an O-ring stem seal—to give it the right start in life. Result—a seal that will pass a helium leak test . . . no packing adjustments . . . no friction even at high pressure. Self-aligning spindle shuts off tight. For instrument panel, test stand, hydraulic or pneumatic service. In carbon, chrome or stainless steel and brass, for ⅛" to ½" pipe sizes. Panel mounted, too, if needed.

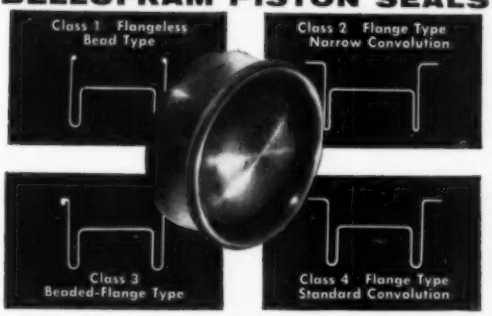
We've got a brand new wall chart as well as catalog information—Both yours for the asking.

HOKE INCORPORATED
Fluid Control Specialists
187 S. DEAN STREET, ENGLEWOOD, N. J.

Circle 66 on Reader Service Card

Circle 17 on Reader Service Card

NOW THERE ARE 4 TYPES OF BELLOFRAM PISTON SEALS


Class 1 Flangeless Bead Type
Class 2 Flange Type Narrow Convolution
Class 3 Beaded-Flange Type
Class 4 Flange Type Standard Convolution

Bellofram long stroke, constant area diaphragms are now available in *four* designs, for efficient use as piston seals in countless types of pressure-sealed mechanisms. Class 1 permits design and manufacture of smaller, lighter, lower cost mechanisms. Class 2 is specially suited to high pressure applications and limited to sizes under 2½". Class 3 allows parting surfaces at flange joint to form a metal to metal joint. Class 4 is suitable for instruments and machines having natural parting surfaces between cylinder and mating metal surfaces.

Bellofram seals are available in any of 300 standard sizes; for 1" to 6" bores; in numerous elastomer-fabric combinations from Nitrile Rubber and Nylon to Silicone Rubber and Dacron. Choice is wide, design and operating advantages many. Outline your needs in confidence.

Have you a copy of the NEW 16-page Bellofram Catalog? Write today.

Bellofram
CORPORATION
BURLINGTON, MASS.

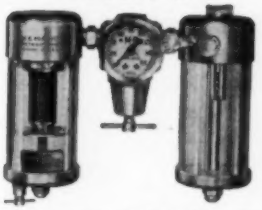
Circle 92 on Reader Service Card

3 in 1 GUARD of the AIR LINE

M·B

WHIRL-A-WAY
FILTER-REGULATOR
and
LUBRICATOR ASSEMBLY
MODEL W-3

the BEST PROTECTION TO YOUR AIR-VALVES, CYLINDERS, PNEUMATIC TOOLS, ETC.



The FILTER removes solids .00039 and larger. TRANSPARENT BOWL provides visibility. REGULATOR capable of passing large volume with unrestricted flow and minimum pressure drop. LUBRICATOR delivers desired volume of oil. Bowl can be refilled without shutting off air supply.

ANY OF THESE 3 DEVICES CAN BE USED AS SEPARATE UNITS OR IN ANY COMBINATION

WRITE FOR LITERATURE

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CHICAGO
March 19-23

M·B PRODUCTS
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DETROIT 3, MICHIGAN

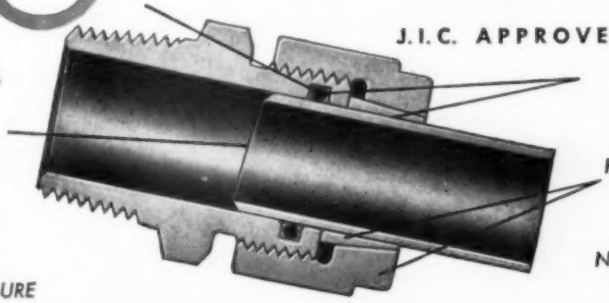
the LENZ "O-RING" TUBE FITTING

J.I.C. APPROVED

NO METAL TO METAL SEAL

NOT NECESSARY TO CUT TUBE SQUARE

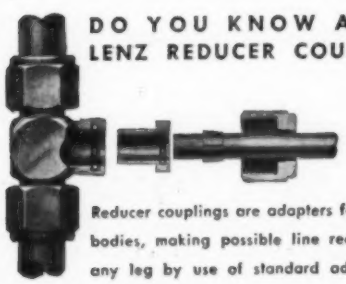
NO CONCENTRATION OF STRESSES DUE TO FLARES OR FERRULES FOR TUBE FAILURE



SEAL AND GRIP ARE SEPARATE

HELD BY FRICTION GRIP OF THESE TWO

NO EXACT TUBE LENGTH NECESSARY



DO YOU KNOW ABOUT LENZ REDUCER COUPLINGS?

Reducer couplings are adapters for standard bodies, making possible line reductions on any leg by use of standard adapters and adapter nuts.

A HACKSAW AND A FILE IS ALL YOU NEED

Excessive wrench torque is unnecessary for seal does not depend upon tightness of the nut. The higher the pressure the tighter the grip. Solve your hydraulic piping problems the easy way . . . with ease of assembly . . . no matching of exact tube lengths . . . simple leakproof connection for the life of the tube.

Reusable collett holds by friction grip up to bursting pressure of tubing.

● LENZ FITTINGS MAKE THE JOB AS SIMPLE AS A B C

LENZ COMPANY

Box 1044 A ● Dayton 1, Ohio ● Oregon 9364

Circle 22 on Reader Service Card

REDUCE HYDRAULIC MACHINE MAINTENANCE AND "DOWN-TIME" UP TO 90%

. . . and you can prove it in your own plant without immediate cash outlay or purchase.
We are willing to prove that this filter will improve precision and production up to 90%. We will send, on memo, the installation of your choice. See pumps, valves and spindles take on new life with a

Briggs
PIONEERS IN MODERN OIL FILTRATION

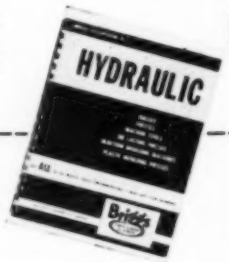
HYDRAULIC OIL FILTER

with interchangeable cartridges for mineral oils, additives oils or non-flammable fluids—for by-pass or high flow installation.

STOPS STICKING VALVES, STUCK SPINDLES, STOPS CORROSION

If excessive "down-time" and too many service calls are eating into your profits try this simple, low cost installation. NO COST until you are satisfied.

MAIL THIS COUPON NOW FOR FULL INFORMATION



THE BRIGGS FILTRATION COMPANY, Dept. 90
RIVER ROAD, WASHINGTON 16, D. C.
Without cost or obligation send me:
..... Copy of your Hydraulic Booklet
..... Installation for up to 15 gal. capacity
..... Installation for up to 30 gal. capacity
Name ..... Title .....
Company .....
Address .....

Useful Literature / continued

for 1¼ and 1½ IPS. Optional features are internal or external piloting, choke block, spool stroke adjustment, check valve, a-c or d-c voltages, and left-hand assembly.

Circle 243 on Reader Service Card

MAGNETIC SHAFT SEALS . . . Magnetic Seal Corp. has released Bulletin No. 3A to indicate features of their Models 10, 20, and 30 seals. Sectional drawings of the seal installation is shown and dimensions are given. The sealing surfaces of the device are held in contact by magnetic force when no fluid pressure exists, thus eliminating a spring to ensure engagement. Standard units are effective under pressures of 3000 psi and temperatures to 300 degrees F.

Circle 244 on Reader Service Card

STEERING BOOSTER . . . for smaller vehicles is presented in Bulletin No. M-5107 from Vickers, Inc. The bulletin discusses the design, construction, and maintenance features of the new booster and in-

MUSCLE-BOUND HOSE
Relieved by Mayson Hose Swivels

Yes it hurts to have your arm twisted. It hurts hose too. Wire reinforced hose breaks at the connector where the wires are bound together and cannot slide over each other. Mayson Hose Swivels relieve this condition.
Your Mayson distributor sells hose and fittings.

He knows hose problems. Chances are that he can recommend a long life installation that will save enough in hose lengths and labor costs to pay for the Swivels. Why not call him in for a consultation.

DISTRIBUTORS

California	Los Angeles 21, Magneto Sales & Service, 751 Towne Ave. San Francisco 24, The Burke Co., 1485 Bayshore Blvd.
Colorado	Denver 16, Hydraulic Service & Supp. Co., 5975 Colorado Blvd.
Illinois	Chicago 39, Flow Products Inc., 5656 W. Diversey
Indiana	South Bend 14, Power Transmission Inc., 302 W. Ewing Ave.
Massachusetts	Fitchburg, Hope Rubber Co., E. Walpole, Knox Inc., 33 Union St.,
Michigan	Detroit 1, Ohio Rubber Supply Co., 59 Selden Ave., Grand Rapids 3, Central Industrial Supp. Co., 1309 Fulton Ave. E.
Minnesota	Minneapolis 3, H.U. Rogness Inc., 135 South 11th St.
Missouri	St. Louis 8, Foster Mechanical Equip. Co., 4262 Washington Ave. Kansas City 11, Zopf Engineering Co., 214 E. 39th St.
New Jersey	Newark 2, Geo. M. Pearse & Co., 1060 Broad St.,
New York	Pelham Manor 65, Nielsen Hydraulic Equip., 4 Penn Place Buffalo 21, C.H. Tapas, 200 Washington Hwy.
Ohio	Toledo 4, Bigelow-Gibson Inc., 900 Summit Ave., Cleveland 14, Webb-Enston Inc., 1121 St. Clair Ave.,
Oregon	Portland 14, Hydra-Lines Inc., 511 S. E. Market St.
Tennessee	Knoxville, Leinart Engineering Co., 412 Fifth Ave. N.E.
Texas	Dallas 20, Associated Factory Representatives, 9935 Witham
Wisconsin	Milwaukee 4, Putrow Industrial Service, 647 W. Virginia St.
Canada	Toronto 18, Stratoflex of Canada Inc., 91 Kipling Ave. S.

MAYSON MFG. CO.
4332 Horatio Street • Detroit 10, Mich.

cludes application and ordering information. Recommended pump and reservoir equipment for use with the S22 booster are also described and typical steering pump performance curves are included. Two typical circuit diagrams are presented in the new bulletin: one shows a conventional steering circuit using a pump having an integral oil reservoir; the other is a drawing of an alternate circuit for use where space limitations preclude installation of the integral oil reservoir.

Circle 245 on Reader Service Card

HOSE ASSEMBLIES . . . Swaged hose, hose ends, and adapters are described in Catalog S-1 available from Weatherhead Co. Also featured in the catalog is a detailed numbering system permitting hose assemblies of any size, type, length, pressure, and quantity to be ordered quickly and easily.

Circle 246 on Reader Service Card

AIR & OIL COMPONENTS . . . The Hydraulic Power Div., The Hydraulic Press Mfg. Co. has issued Condensed Catalog No. 1101 to illustrate and describe their complete line of cylinders, valves, pumps, motors, power units, and accessories. Gear pumps and variable displacement, radial piston pumps are shown with gear motors and complete hydraulic power units. The radial piston pump can be fitted with pressure compensating control and with auxiliary circulating and pilot pump. Cylinders are shown in various designs for service to 3000 psi. A complete line of directional, flow control and pressure control valves is shown with diagrams to indicate operation. Accessories including subplates, heat exchangers, gage snubbers, pressure gages, strainers, couplings, O-rings, and slip joints are also shown.

Circle 247 on Reader Service Card

OIL FILTERS . . . incorporating a honeycomb design filter tube are featured in Catalog PM 200-A prepared by Commercial Filters Corp. The material reviews numerous types for industrial use manufactured by the company. The filter tubes are available in nylon, orlon, dynel, acetate, and glass as well as cotton. The exclusive method of manufacture permits precision control of density and makes it possible to provide a wide range of tubes of varying filtration characteristics.

Circle 248 on Reader Service Card

Here's the way National insures uniform high quality in National O-Rings:

All ingredients are of highest quality, carefully inspected before compounding. Compounding is done under strict controls to insure absolute uniformity of batches. Molding is done on modern equipment by skilled veterans in O-Ring manufacture. Rings are given a complete precision trim, then complete inspection. Every precaution is taken to insure that no O-Rings with cuts, scratches or mold defects are shipped.

A complete line of industrial O-Rings, including the new small cross-section rings, is available for prompt shipment from convenient warehouses. Prices are most competitive. Call the nearest National Applications Engineer and prove this to yourself!

NATIONAL
OIL & GREASE SEALS
O-RINGS SHIMS

NATIONAL MOTOR BEARING CO., INC.

GENERAL OFFICES: REDWOOD CITY, CALIFORNIA
PLANTS: REDWOOD CITY AND DOWNEY, CALIFORNIA; VAN WERT, OHIO

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REDWOOD CITY, CALIF. . . *Broadway and National, EMerson 6-3861*
WICHITA, KANSAS . . . . . 519 *South Broadway, AMherst 2-6971*

Circle 103 on Reader Service Card

Post Scripts of Industry

News about people, manufacturers and sales organizations

Bruce H. Pauly
The Weatherhead Co.

James G. Tuthill
Tuthill Pump Co.

Henry Risko
U.S. Hoffman Machinery Corp.

The Weatherhead Company has named **Bruce H. Pauly** as associate director of research. He will be responsible for the planning and direction of all phases of aircraft research and development activity for the company. Before joining Weatherhead, Pauly was concerned with the development aspects of fuel and hydraulic pumps and controls for aircraft and turbo-jet engines.

James G. Tuthill, was elected president of **Tuthill Pump Company,** succeeding H. T. Kessler who retired. Grandson of the founder of the company and son of the late chairman of the board, Tuthill joined the company in July 1953. He served in various capacities in the organization, was made vice-president last year.

The following changes in the official organization of **Joy Manufacturing Company** have been announced: **J. D. A. Morrow** was elected chairman of the board. Succeeding Morrow, **John Lawrence** was advanced to president and chief executive officer. **W. L. Leary** to executive vice president. **H. C. Nyquist** to vice president—general sales. All other officers were re-elected.

Henry Risko was named sales manager of the Industrial Filtration Division of the **U.S. Hoffman Machinery Corp.** With the company since 1942, he was a service engineer and was appointed in 1952 division service manager.

Mervin W. Serchet has joined the Oil Hydraulics Division of the **Webster Electric Company.** A graduate of Purdue University, he was previously associated with the Line Material Company as an industrial engineer.

J. N. Fauver Co., Detroit, is opening a branch office and warehouse at G-3140 East Hemphill Road, Flint, Mich. This office, in charge of **John W. Mestrezat,** has been authorized to stock and service products manufactured by **Parker Appliance Co.**

To provide users of oil-hydraulic systems in Wisconsin, North Dakota, Minnesota, northern Illinois and northwestern Indiana with special facilities and services, **Vickers Incorporated** have opened a Midwest Branch in Chicago. The new 18,000 square foot building, located at South Kildare at Fillmore, will include facilities for service, repair, warehousing and custom production activities.

William W. Dickhart, III, was named chief of the machine design and development section of **The Franklin Institute Laboratories,** Philadelphia. During his four years as a member of the laboratories' engineering mechanics section, Dickhart has been engaged in designing, analyzing or trouble-shooting, and testing machines for various clients of the Laboratories.

Continued on page 164

Circle 96 on Reader Service Card

THE *Right* GAUGE FOR YOUR SPECIFIC NEEDS

MARSHALLTOWN

• Available in a wide variety of general purpose and special purpose gauges in pressure ranges to meet your specifications in every particular.

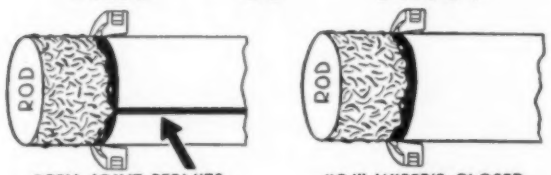
WRITE TODAY FOR COMPLETE INFORMATION

PRESSURE, VACUUM, COMPOUND, ALTITUDE, COMBINATION, DIAPHRAGM, HYDRAULIC, AND SPECIAL PURPOSE GAUGES, DIAL THERMOMETERS, (VAPOR TENSION OR BI-METAL)

MARSHALLTOWN MFG. CO.

800 East Nevada St., Marshalltown 4, Iowa

This or This?



OPEN JOINT PERMITS A STREAK OF DIRT AT JOINT OPENING

"CJ" WIPER'S CLOSED JOINT KEEPS THE ENTIRE ROD CLEAN

For those dry operations requiring absolute freedom from dust or dirt passing through joint of ring to bearings or packings, we have especially designed—the

FALL WIPER RING with Closed Joint

(our P/N-FWR-CJ)

In addition to the above, and since 1944, we have also manufactured **For Army and Navy Use** the 3 Piece **FALL WIPER RING FWR-3C**

Spec. Mil-S-5049, AN Approved, Military part numbers from AN6231A1, ½", to AN6231A71, 13", diameter. This ring consists of 3 pieces assembled into one . . (1) a one-piece Split Wiper Ring (Body) with 2 flanges or groove in its O.D.; (2) a one-piece split compressor spring assembled in groove (3) an endless cover band surrounding spring in groove which causes squeeze grip action on piston rod.

Squeeze Grip Action Does It—patented

—and squeeze grip is always the same because uniform tension of spring under endless cover band. Rods or pistons do not stick or become immobile in ANY temperature.

Our engineers will gladly work with you on any wiper ring problem. Write, wire or phone us.

Ace Products Co., Toledo 1, Ohio
Phone Cherry 36513

Fall Wiper Ring SPRING LOADED

Covered by patents issued and patents pending.

$18.50 List Price*

*$18.50 is the list price for the ¼" port size and $19.50 for the ⅜" less usual quantity discounts.

250 P.S.I. 4-WAY VALVES for Air and Cost-Minded TOOLING and PRODUCTION MEN

Important Savings	Low initial cost. Need no oilers and filters (time and materials savings).	All components are corrosion resistant.
Low Maintenance	Sealing qualities do not diminish with long, continued use.	Wear compensating "Shear-Seal" design.
Long Service Life	No production delays. Maintenance (rarely needed), without disturbing plumbing.	Lapped metal to metal sealing members.
Not Critical to Dirt	No scoring or binding. (As with spool or poppet designs.)	Flow is through "Shear-Seals." Sealing surfaces remain in constant intimate contact.
No Creeping Cylinders	Leakproof closure. (No internal port to port leakage.)	Maintained through lapping action of each operation.

Ask for bulletin A-5.

Foot operated models with or without spring return to reverse or to center are $24.50 list for the ¼" and $25.50 for the ⅜" valve less quantity discounts.

BARKSDALE VALVES

5125 Alcoa Avenue, Los Angeles 58, California

Circle 1 on Reader Service Card

Circle 16 on Reader Service Card

Post Scripts of Industry
continued

Silicones Division, Union Carbide and Carbon Corporation has been formed to take over the responsibility for the development, manufacture and sale of silicone products. This new Silicones Division will assume responsibilities in the field of silicones previously handled by Linde Air Products Company. Silicones which have been marketed under the Linde trade mark will now be called Union Carbide Silicones.

The New York Air Brake Company announced the following appointments: **Byron Nierenberg,** formerly a sales engineer for the Stratopower Division of N.Y. Air Brake, was named administrative assistant to the vice president of aviation sales. With the company since 1952, he has had broad experience in the hydraulics and aircraft industries.

Elmer V. Mrozek was assigned to represent the Hydreco and Dudco Divisions in the greater Chicago area. He was previously associated with the Donnell Hydraulic Company. **John G. Wood,** who has been executive engineering consultant was elected a director of the company, succeeding Horace A. Harding.

Elmer V. Mrozek
N.Y. Air Brake Co.

Byron Nierenberg
N.Y. Air Brake Co.

John G. Wood
N.Y. Air Brake Co.

LOOK TO FOR DEPENDABILITY

CIRCLE SEAL

• CHECK
• RELIEF
• SHUT-OFF

LEAK PROOF VALVES

T-900 Series . . . Toggle Operated Shut-off Valve . . . Quick acting toggle lever operation with positive leak-proof shut-off. Fool proof, maintenance free, with no adjustments required. Snap it's open . . . snap it's closed . . . dead tight. For liquid or gas—for any pressure up to 3000 PSI. Operates smoothly and easily up to full rated capacity.

Representatives in Principal Cities
SEND FOR INFORMATION

JAMES • POND • CLARK
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PNEU-MUFFLER

STOP EXHAUST NOISE
of air-operated equipment
with ATOMUFFLER . . .
4-44 Radial Full-Flow
Muffling Action!

(Muffles—Without reducing air-flow)

• FULL-FLOW ATTENUATION
With Radial Full-Flow muffling, exhaust air is not restricted. Performs at top efficiency regardless of air volume or pressure. Sturdier construction and improved wear quality designed to give better service, efficient and longer trouble-free performance.

• EFFICIENT NOISE REDUCTION
Atomuffler stops 99.9% of objectionable noise of air-operated equipment. Completely eliminates injurious noise hazard. Easily installed, made in eight standard pipe sizes, economically priced.

• IMPROVES WORKING COMFORT.
Protection from annoying exhaust noise and improved operating comfort are important user benefits. Prevents fatigue slowdown and frayed-jumpy nerves. Send for descriptive literature and name of local distributor.

Recommended by Liability Insurance Companies

Allied Witan Company, Inc.
Representatives in Principal Cities
Cleveland, Ohio

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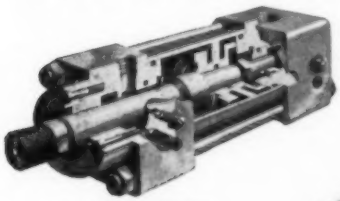
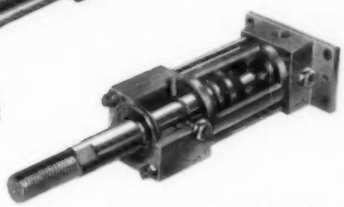
PETCH CYLINDERS

meet J.I.C. & NC-I STANDARDS *providing* "MOTOVATION for AUTOMATION"



☐ TIE-ROD Design
Low Pressure Hydraulic 500 psi—1½"-10" bores; High Pressure Hydraulic 1500 psi 1½"-6" bores; Air 200 psi—1½"-10" bores



☐ AUTOMOTIVE
heavy duty AIR
200 psi—1½"-6" bores

☐ BOOSTERS
Drive Cylinders 4", 5", 6", 8" bores Ratios 5:1 to 28.5:1

☐ TANKS
4"-10" bore sizes

Petch Hydraulic Devices include:

☐ HUPP Threadless Sub-Plates—Inserts & Swivel Fittings

☐ Limit Switch Actuator

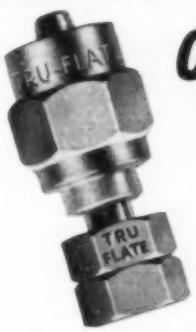
☐ Oil Tank Sight Gauge

Send for catalog regarding the product or products for which you have use—each one includes complete specifications and engineering data. The complete PETCH portfolio consists of 96 pages of hydraulic and pneumatic information.

PETCH (pmc)

465 York, Detroit 2 **MANUFACTURING COMPANY**

REUSABLE FITTINGS FOR OXYGEN and ACETYLENE



- *SPLICERS*
- *ADAPTERS*
- *COUPLERS*
- *NIPPLES*

These Tru-Flate reusable fittings can be assembled on the spot without special tools or crimping devices. Assembly is made with pliers or vise and set screw wrench. Can be easily disassembled to be used many times. Neat, streamlined appearance, lightweight, leakproof, durable.

Write for Catalog Sheets

TRU-FLATE, INC.
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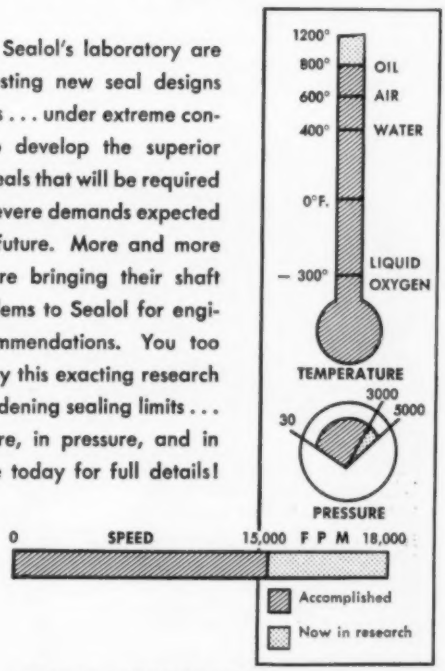
Constant Research And Development Keeps SEALOL In Pace With Progress!

Engineers in Sealol's laboratory are constantly testing new seal designs and materials . . . under extreme conditions . . . to develop the superior mechanical seals that will be required to meet the severe demands expected in the near future. More and more companies are bringing their shaft sealing problems to Sealol for engineered recommendations. You too can benefit by this exacting research which is broadening sealing limits . . . in temperature, in pressure, and in speed. Write today for full details!



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181 POST ROAD, PROVIDENCE 5, R. I.

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SEALOL

THE BALANCED PRESSURE SEAL

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Post Scripts of Industry
continued

The Well Equipment Mfg. Corp., an operating Division of **Chiksan Company** is constructing a new plant in Houston, Texas. Expansion will provide Chiksan customers with a second source for Chisan swivel joints and increased production of WECO products. The new facilities, to be completed the middle of this year will consist of a 64,000 square foot completely air conditioned shop, several smaller production buildings and an office building.

Wm. W. Nugent & Co., Inc. has opened their new plant at 3440 Cleveland Street, Skokie, Illinois.

Hydraulic Research and Manufacturing Co., a subsidiary of the Bell Aircraft Corp., named **H. Koppenhafer** as sales manager.

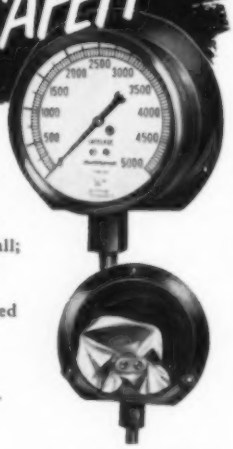
Ralph E. Fritzsche will serve in the Youngstown, Ohio office and **George J. Lawson** in the New York office as district engineer for the **Clark Controller Company.**

Raymond Jensen has joined the **George W. Chipley Company,** Milwaukee, representatives for Conoflow Corporation, as a sales engineer.

Automatic Switch Company has named **Leen's Electric Motor Service,** Brewer, Maine, as authorized stocking distributor in the state of Maine.

Superior Tube Company Norristown, Pa., has begun construction of a new plant and office building near the site of its present Wapakoneta, Ohio, plant which the new facilities will replace. The one-story mill building will comprise 55,000 square feet and the attached two-story office building 8,000 square feet. The entire plant will be operated under a quality control program with quality control beginning with incoming raw materials and continuing through every stage of processing.

New advance in... GAUGE SAFETY



Another Marsh development... new "SAFE-CASE" gauge for those conditions where over-pressures of explosive force can occur.

Face well protected by solid metal wall; but, still more important, *entire back* is thin metal plate that opens out to exhaust any abnormal pressure.
In testing, heavy blank cartridges, fired within back of case, did not even break crystal.
Use "Safecase" for your toughest services. It is standard in Marsh "Mastergauge"—the highest development in pressure gauges.
Ask for facts.

MARSH INSTRUMENT CO.,
Sales affiliate of Jas. P. Marsh Corp.
Dept. 19, Skokie, Ill.
HOUSTON BRANCH PLANT: 1122 Rothwell St. Sect. 15, Houston, Texas
Marsh Instrument & Valve Co. (Canada) Ltd., 8407 103rd St., Edmonton, Alberta, Canada

Test Proves Safety
Explosive force of cartridge merely opens out safety-release back. Back is firmly attached to case and cannot be dislodged during a pressure blow-out.

MARSH GAUGES

AIR-HYDRO-PUMP
60,000 PSI
HYDRAULIC PRESSURE
(with air-100 psi)
COMPLETE RANGE OF 35 STANDARD MODELS,
SINGLE OR DOUBLE ACTING

- Air-Hydro-Pump is the finest pressure unit for rapid testing of valves, boilers, piping pressure vessels.
- Sustains constant pressure on Rolls, Rams, Presses.
- Portable for site testing.
- Water, Oil, Diluted Alkalis or Acids can be used.
- Made of non-ferrous metals and stainless steel.

Also 6 JUNIOR MODELS
Fluid pressures 400 psi to 10,000 psi $185.00 f.o.b. New York

DAVIES BROS. 120 WALL ST., N.Y. 5, N.Y.

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THE ORIGINAL
MONOPAK—CARTRIDGE

A complete packing unit for hydraulic or pneumatic rods or cylinders.

- Easily installed or replaced.
- Needs no adjusting.
- Reduces initial machining expense.
- Longer service life.
- Includes "Seal-Guard" rod wiper.
- Low friction coefficient.
- Shock and burst proof.
- Cuts machine down-time.

*Detailed literature on request.

HYDRAULIC ACCESSORIES CO.
24301 Hoover Rd. Van Dyke, Mich.

Have you ordered your extra copies of the January 1956 issue?

Fluid Power Engineering Index

. . . of over 250 publications (1931-55)

Here's a valuable reference you and your associates will be using for a long time. This is the only published index which gives you a source of articles, books, reports and films dealing with the design, application and maintenance of hydraulic and pneumatic equipment.

50c per copy

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APPLIED HYDRAULICS Magazine
1240 Ontario St., Cleveland 13, Ohio

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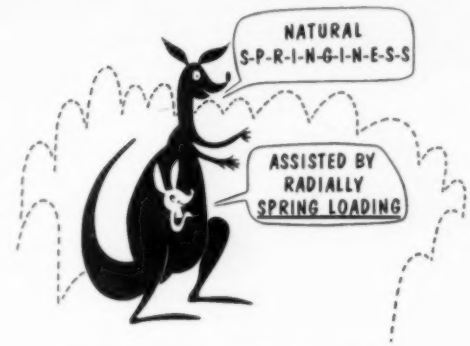

WIGGINS

AN 6231A SERIES
TO
SPECIFICATION MIL-S- 5049
OR
ANY COMMERCIAL DESIGN.

GEO. W. GAYLE & SON
PRECISION METAL PARTS TO SPECIFICATION
FRANKFORT, KENTUCKY

WIGGINS **INST-O-MATIC** COUPLINGS

QUICK—DISCONNECT

use **WIGGINS COUPLINGS** for

OIL
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Manual Quick Disconnect (Push-Pull Positive Action)

Automatic Quick Disconnect (Breaks Away at Pre-determined Weight Load)

SIZES: ¼" TO 2½

WRITE FOR FURTHER INFORMATION

Wiggins

E. B. WIGGINS OIL TOOL COMPANY, INC.
3424 East Olympic Boulevard, Los Angeles 23, California

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Post Scripts of Industry

continued

John McKinlay has been appointed assistant sales manager of the Packing Division of **Raybestos-Manhatten, Inc.** A University of Colorado graduate, McKinlay started with the Packing Division in 1952 and served as district and special representative in various locations. He is now at the sales headquarters in Passaic, N.J.

John McKinlay
Raybestos-Manhatten, Inc.

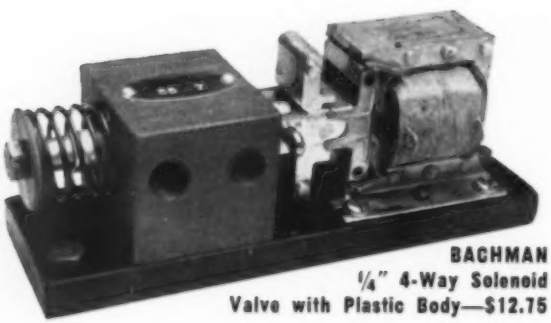
Fawcett, Preston & Co. Ltd. of Bromborough, England, and **Finney Presses Ltd.,** Birmingham, England, have announced the formation of a joint sales and service company. Known as **Fawcett-Finney Ltd.,** this company will coordinate manufacturing programmes and provide integrated sales and service facilities. Headquarters of the new company are in Birmingham with regional sales offices in London, Bromborough and Bristol.

The Chicago area branch office of **The Hydraulic Press Manufacturing Company** has moved to new quarters at 911 Busse Highway, Park Ridge, Illinois. This office serves as headquarters for district manager Don C. Youngblood, assistant manager B. D. Ashbaugh, and service engineers C. Gompf, Del Barrick, and S. Seif.

Stillman Rubber Company announced the election of **Joseph Carol** as secretary-treasurer.

S. Wyman Rolph (left) president of the Franklin Institute of Philadelphia, presents a scroll and the Edward Longstreth Medal of the Institute to Richard Y. Case, chief engineer power transmission department, United States Rubber Co., for inventing the timing belt.

The Alpha Molykote Corporation has appointed **Penn Petroleum Company,** Detroit, as exclusive distributor for Molykote lubricants.



BACHMAN
¼" 4-Way Solenoid
Valve with Plastic Body—$12.75

If you are looking for low cost dependability here is a constant duty direct solenoid valve for 200 psi with ¼" orifice—at a price below most hand operated valves. The body is machined from tough canvas base phenolic with ports perpendicular to the laminations.

These valves give millions of cycles of quiet and trouble-free service because the resilient construction *quietly* absorbs the kind of punishment that damages harder materials.

Stems are hardcoated aluminum and permanently resist wear or abrasion. Seals are standard O-rings.

With these units you can operate, check or cushion air cylinders. In air-hydraulic systems they will provide positive check or dwell. Use them for many combinations of manual or automatic control. The valve illustrated is 7" long, weighs 2 lbs. and mounts in any position. Other models have double solenoid and also hand, foot or mechanical actuation. All have ½" stroke with spring return optional.

Let us mail you complete literature or ask us to send you one of these units for a 30 day test and decide for yourself whether this long life leakproof valve can save you money.

JOHN D. BACHMAN & CO.

1713 Sperger Lane — Bristol, Tennessee

FOR CLEAN, DRY AIR

Distributing Line Of Cool Air From Receiver Tank
Vapor Free Air Near Point Of Use
Take Off From Top Of Pipe
Replaceable Desiccant

MURPHY TRIUMPH AA SEPARATOR-FILTER
Sizes: ¼, ⅜, ½, ¾;
Weight 30 lbs; Pressures: 0 to 125 psi;
Price: $71.00 ea; Desiccant refills $1.00 ea.

After precooling and separating compressed air, this small unit, placed close to the point of use will finish the job of removing last traces of impurities.

Where very particular work demands dry air completely free from any trace of oil or vapors Murphy Triumph AA is the answer.

AFTERCOOLERS FOR 10 CFM TO 10,000 CFM—SEPARATORS—TRAPS

JAS. A. MURPHY & CO. INC.

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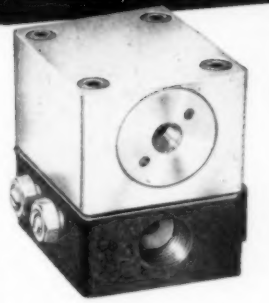
AUTOMATION AT LOW COST ...ON ANY OPERATION

WITH THE

CARTER Cartridge AIR VALVE



Now, completely automate *any* air cylinder operation. Speed up production with positive, fast action cycles. Solenoid or air poppet control. Stainless steel and nylon wear-parts for long wear. Ask your Carter representative or write.

Carter Controls, Inc.
2972 Bernice Road
Lansing, Ill. • GRanite 4-3305

IT'S UNITIZED!

- Cartridge Solenoids
- Cartridge Lever or Palm Poppets
- Cartridge Power-Head
- Nylon and Stainless Wearing Parts
- Corrosion Proof Construction
- Built-in Speed Controls
- Simplified Maintenance

Once installed, all working parts may be replaced without removing valve or disturbing any existing pipe connections.

EVERY ENGINEER WILL WANT A COPY OF THIS
NEW BULLETIN

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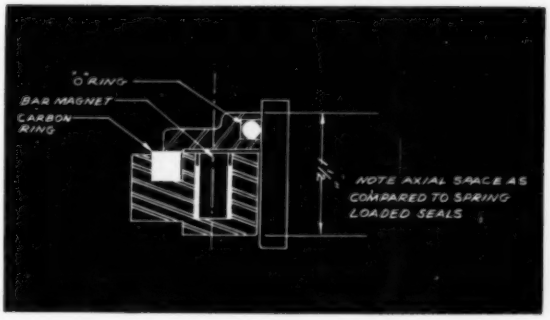


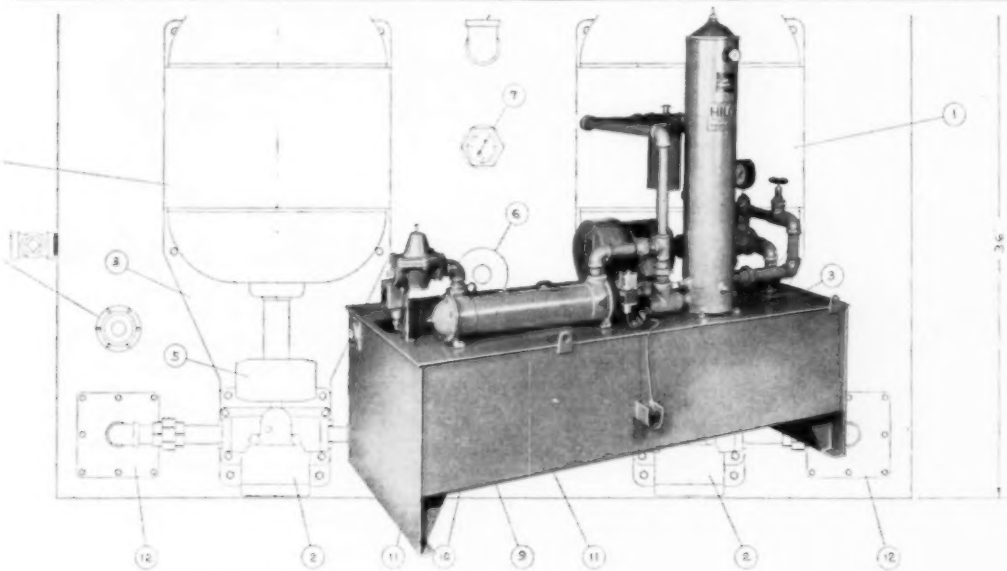
We've done it again...a 10" SEAL

This seal is our latest in a line of rotary shaft seals developed for large diameters. Occupying no more than 1½" axialy along the shaft, the Seal employs magnetic inserts the number of which is determined by the size of the seal. By providing improved balance pressure, the seal eliminates warpage on the face sealing surfaces, therefore there are no hot spots and possibilities of leakage. No matter what your sealing problem, there is a Magnetic Seal to meet your needs.

Contact Magnetic Seal for further information on uses and applications of hydraulic shaft seals . . . or submit your sealing problems for engineering data and recommendations.

MAGNETIC SEAL CORP.

301 SOWAMS ROAD • BARRINGTON, RHODE ISLAND



Develops 20 GPM @ 70 PSI with 1200 SSU oil.
Full Flow and By-Pass Micronic Filtration.
3 HP 1200 RPM motor.
Heat Exchanger and Pressure Reducing Valve.

APPLICATION:
Bearing Lubrication for Aluminum Foil Mills

The **CARDWELL MACHINE COMPANY**
Franklin at 19th St., Richmond 11, Virginia • Phone 7-4593

REVISIONS	THE CARDWELL MACHINE CO. RICHMOND, VA.		
	CARDWELL PRESSURE LUBRICATION UNIT MODEL PL18L-150		
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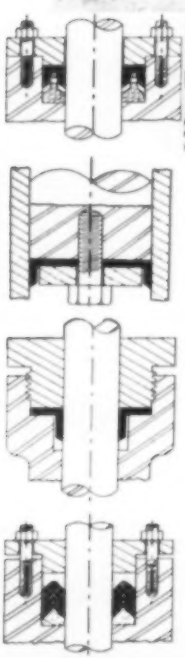
	CHK. BY C.V.A.	SCALE 3/16"=1'-0"	

for honing and polishing

. . . you can't beat leather



. . and you can't beat Tannate Leather Packings for their inherent tendency to hone or "lap" in the metal parts upon which they work. Other packing materials operating under the same conditions have a tendency to score, yet Tannate Packings will not score or abrade the most highly finished surfaces.

Tannate Packings are precision molded and accurately finished for a most effective leak-proof seal. Tannate packings are job engineered from start to finish to meet your exact requirements.

If you design or maintain cylinders or presses send for Rhoads new Packing Hand Book now. Write J. E. RHOADS & SONS, 2100 W. 11th St., Wilmington 99, Del.

RHOADS

INDUSTRIAL LEATHERS

Wilmington New York Chicago Atlanta

Post Scripts of Industry

continued

Geo. D. Roper Corp. made these new appointments: **L. E. Laidlaw** of the Laidlaw Company, Indianapolis, Indiana, was named district sales manager. He will cover the state of Indiana and western Kentucky. **E. H. Bigden** has become district sales manager for the St. Louis territory and will also handle the area of eastern Missouri and southern Illinois.

L. E. Laidlaw
Geo. D. Roper Corp.

E. H. Bigden
Geo. D. Roper Corp.

Pines Engineering Co., Inc., Aurora, Ill., have acquired all assets and patent rights of **Rotomation Motors, Inc.,** Greenville, Ohio. It will operate as a separate subsidiary, known as **Roto-Mation, Inc., G. F. Behrend,** former district sales manager of Pines was promoted to vice president in charge of sales of the new company and will operate from the Ohio plant. Other officers of the new corporation are: **Byron F. Bower,** chairman of the board; **I. W. Killian,** president; **Frederick R. Drake,** vice president-engineering; **Victor Stegenga,** vice president-production; **Glenn T. Johnson,** treasurer; and **Fred F. Klebe,** secretary.

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MARKET PLACE

SALES ENGINEERS—WEST COAST

Expansion creates outstanding territories in Seattle, San Francisco and Los Angeles. We are the exclusive distributors for nationally known top air and hydraulic lines. Large local inventories maintained. Our own top flight engineering department and shops design and build special machinery. Applicants, not over 40, must have technical and sales background in field of applied air and hydraulics for industry. Substantial salary plus commissions and expenses with well developed territory offered. Resumes will be handled in confidence. Local interviews arranged. Write C. J. Woodward, V.P., The Rucker Company, 4700 San Pablo Avenue, Oakland 8, California.

PITTSBURGH & TRI-STATE AREA—LINES WANTED

Sales engineer 39 with 10 years experience in direct factory sales and service, handling air and hydraulic components, wants direct factory connection as manufacturers representative on straight commission basis. Well acquainted in this area and can show top sales record. Box 1356, APPLIED HYDRAULICS.

AVAILABLE SALES ENGINEER

Top level industrial sales experience in air and hydraulic components; machine tool and accessories; in the Detroit area. Background in tool and machine design, hydraulic and electrical circuitry. Seeking high potential connection with air and hydraulic or machine tool manufacturer. Age 34, college, family, personable. Write Box 2356, APPLIED HYDRAULICS.

DEVELOPMENT ENGINEER

Aircraft Hydraulic Component Development

Small but aggressive staff research and development department of prominent Cleveland manufacturer has a ground-floor opportunity for a hydraulic design or development engineer having creative and analytical apptitude. He will have overall project responsibility in a long-range program to develop new hydraulic components for advanced aircraft and missile applications. An excellent salary is offered to a qualified engineer having approximately 5 years industrial experience. Box 3356 APPLIED HYDRAULICS.

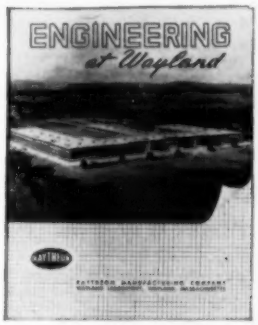
CHIEF ENGINEER—SOLENOID VALVES

A well established Midwest manufacturer of two-way solenoid valves seeks a chief engineer to head up design and development. Experience in development work essential, preferably in the field of hydraulics and pneumatics. Must be capable of taking charge of all engineering activities. Salary open, profit participation. All present employees know of this notice. Send resume Box 4356, APPLIED HYDRAULICS.

HYDRAULICS ENGINEERS

With experience in:

- **Hydraulic Servo Control Systems**
- **Design of Hydraulic Components for aircraft**
- **Close tolerance machine design**



Airborne weapons systems have been added to the list of applications for Raytheon's hydraulic control systems. The recent expansion of our engineering facilities makes it possible to offer unusual opportunities to experienced creative engineers.

Beginning salary range—$6,000 to $10,000.

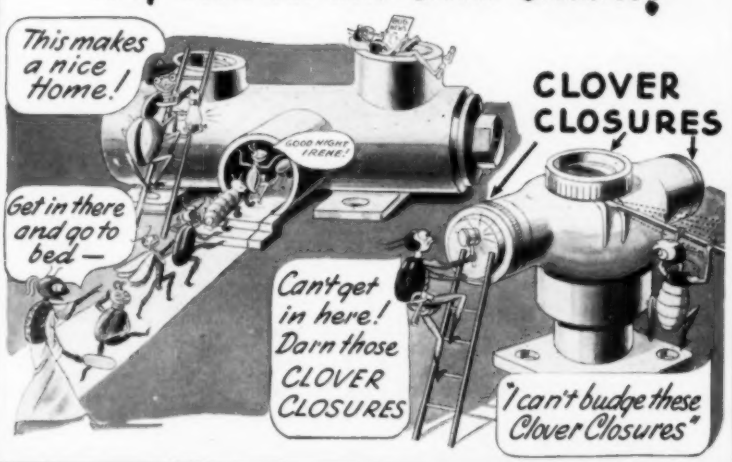
A brief resume form and a copy of this brochure describing our new laboratory may be obtained by writing to Mr. Robert E. Doherty.

RAYTHEON MANUFACTURING CO.
WAYLAND LABORATORY WAYLAND, MASS.

RAYTHEON

- Full tuition paid for accepted educational programs.
- Location convenient for country or city living.
- Progressive salary review system.
- Liberal employee benefit program.

You've taken the bugs out of your product— Keep them out with Clover Closures!


This makes a nice Home!
GOOD NIGHT IRENE!
CLOVER CLOSURES
Get in there and go to bed—
Can't get in here! Darn those CLOVER CLOSURES
"I can't budge these Clover Closures"

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PLASTIC

METAL

Metal or Plastic Immediate Delivery

Clover Closures protect your product from dust, dirt, moisture and thread damage. Write for free samples and literature.

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SEND your specifications for hydraulic cylinders to American, specialists in hollow boring and honing. We manufacture from tubing or forgings in carbon or alloy steels up to 15" I.D. Over 40 years experience backed by precision machines and skilled craftsmen will save you time and money. Send your blueprints.

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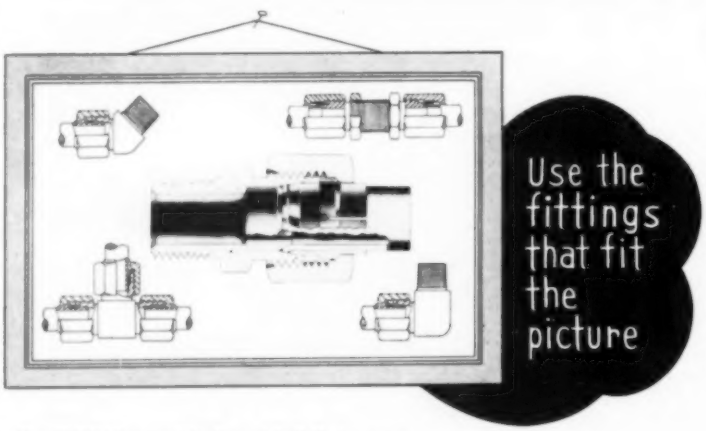

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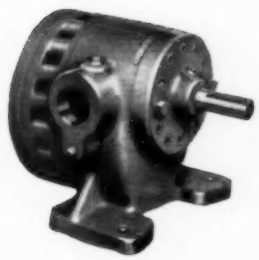

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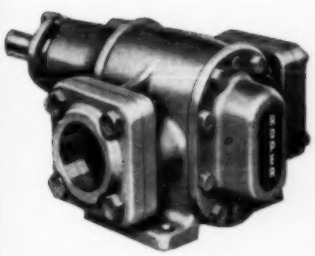

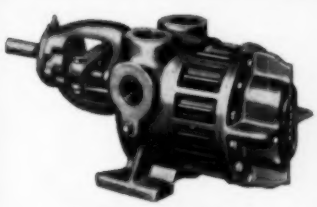

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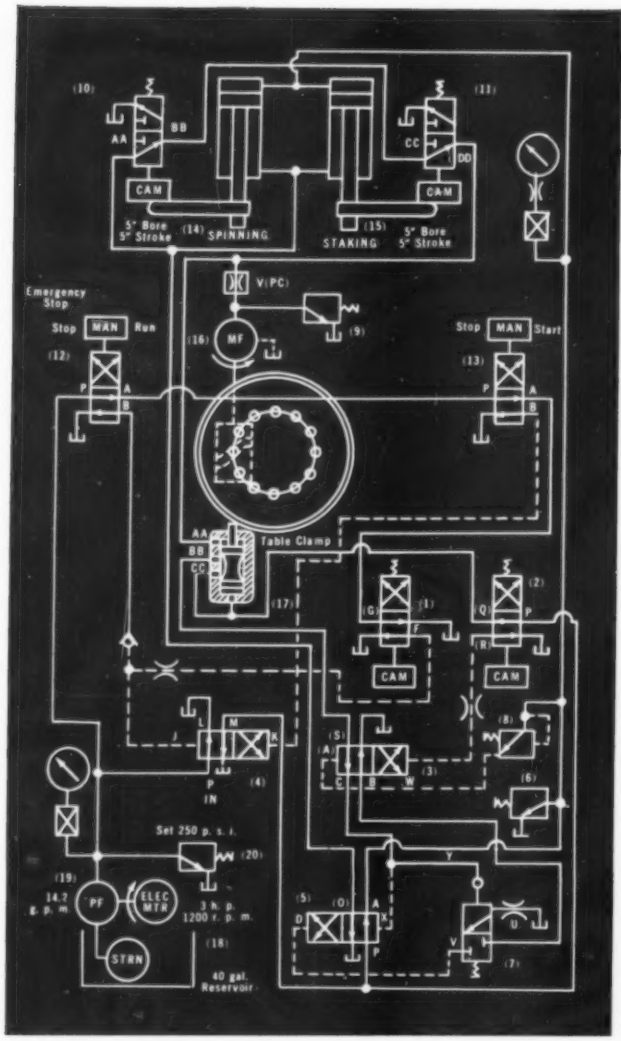

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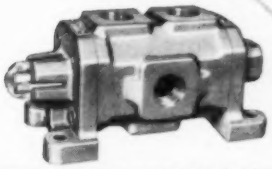

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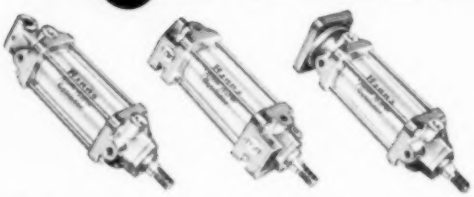
Hanna

FLUID T750 SERIES POWER CYLINDERS



The new Hanna T750 Series cylinders are the last word in smooth, dependable performance. These rugged, compact cylinders are built for air operation to 250 p.s.i. and oil or water operation to 750 p.s.i. Many mounting styles and interchangeable heads make these cylinders exceptionally versatile. Available in 1½", 2", 2½" and 3" diameters.

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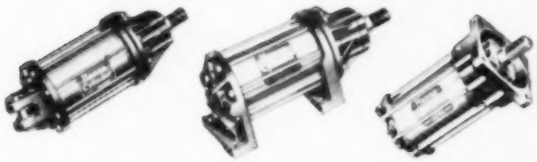
Hanna LP

AIR & HYDRAULIC CYLINDERS



For low pressure air and hydraulic operation. Thousands of varied applications have proved the quality and reliability of these Hanna cylinders. Bore sizes range from 4" to 14". These cylinders, combined with Hanna T750 Series cylinders, offer a complete range of cylinder sizes and mounting styles. Made in any practical stroke length.

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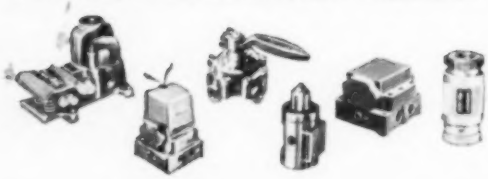

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Hanna Filters, Lubricators, Regulators, Traps

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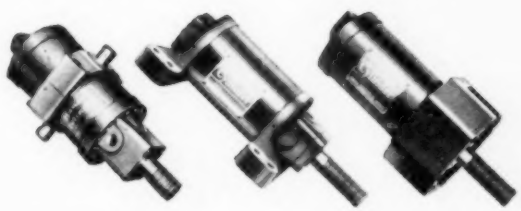
Hanna HP

HYDRAULIC CYLINDERS



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